UNITED STATES PATENT AND TRADEMARK OFFICE **CERTIFICATE OF CORRECTION**

PATENT NO.

: 7,312,845 B2

Page 1 of 151

APPLICATION NO. :10/656469

DATED

: December 25, 2007

INVENTOR(S)

: Kia Silverbrook

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page, should be deleted and substitute therefor the attached title page.

Drawings:

Delete drawing sheets of 1-148 and substitute therefor the drawing sheets of 1-149 as shown on the attached pages.

Signed and Sealed this.

Ninth Day of December, 2008

JON W. DUDAS Director of the United States Patent and Trademark Office

(12) United States Patent

Silverbrook

(10) Patent No.:

US 7,312,845 B2

(45) Date of Patent:

*Dec. 25, 2007

(54) METHOD OF CAPTURING AND PROCESSING SENSED IMAGES

- (75) Inventor: Kia Silverbrook, Balmain (AU)
- (73) Assignee: Silverbrook Research Pty Ltd, Balmain, New South Wales (AU)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 484 days.

This patent is subject to a terminal disclaimer.

- (21) Appl. No.: 10/656,469
- (22) Filed: Sep. 8, 2003

(65) Prior Publication Data US 2004/0075821 A1 Apr. 22, 2004

Related U.S. Application Data

(63) Continuation of application No. 09/922,274, filed on Aug. 6, 2001, now Pat. No. 6,618,117, which is a continuation of application No. 09/113,053, filed on Jul. 10, 1998, now Pat. No. 6,362,868.

(30) Foreign Application Priority Data

Jul.	12,	1997	(AU)	PP797
Jul.	15,	1997	(AU)	PO799

(51) Int. Cl. G03B 27/00 G03B 17/00

(2006.01) (2006.01)

- - 396/57, 48, 211; 386/239, 101; 705/51 See application file for complete search history.

(56) References Cited

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(Continued)

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1/2000

(Continued)

OTHER PUBLICATIONS

Petit L et al., "VLIW processor architecture adapted to FPA's Proceedings of the SPIE--The International Society for Optical Engineering SPIE-INT.SOC. OPT.ENG. USA, vol. 3410, 1998, pp. 128-132, XP002353310 ISSN: 0016-786X.

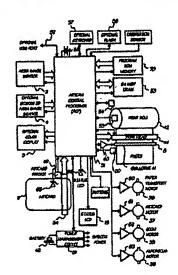
(Continued)

Primary Examiner-Peter B. Kim

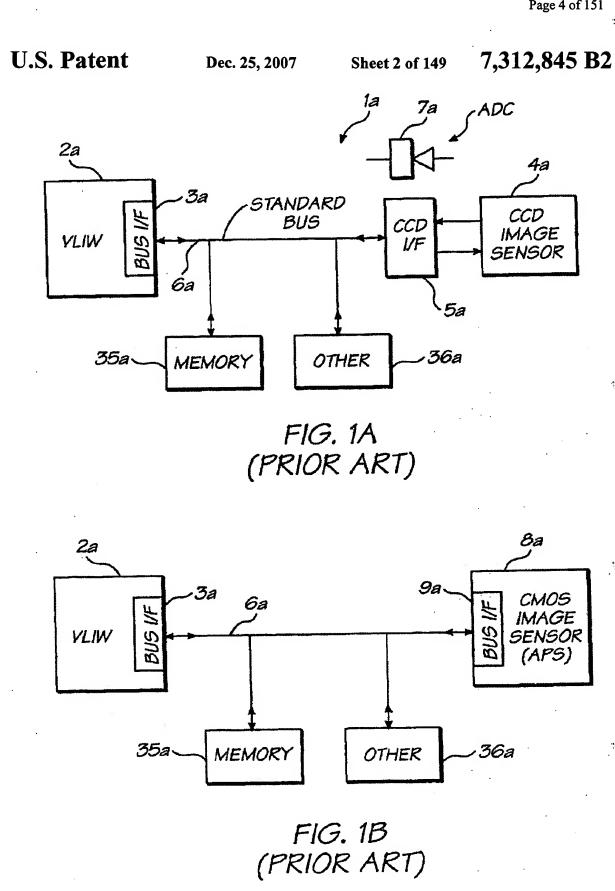
57) ABSTRACT

A method of capturing and processing sensed images includes the step of sensing a viewed image to generate a viewed image signal carrying data representing the viewed image. The viewed image signal is communicated to a central processor. A printed data storage device on which optically detectable data representing an image processing program is printed is read to generate a program signal carrying data representing the program. The program signal is communicated to the central processor. The program is executed at the central processor so that the central processor carries out an image processing operation on the viewed image in accordance with instructions carried by the program to generate output image data.

6 Claims, 149 Drawing Sheets



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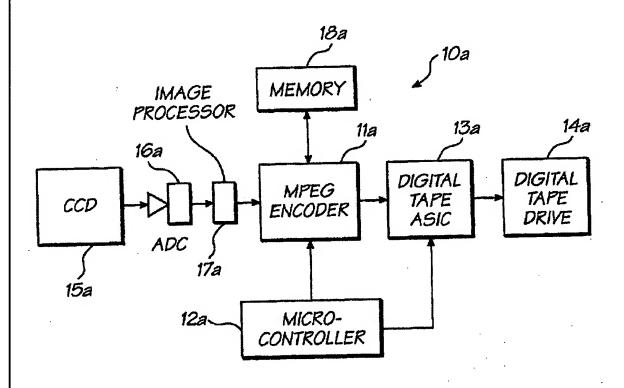


FIG. 1C (PRIOR ART)

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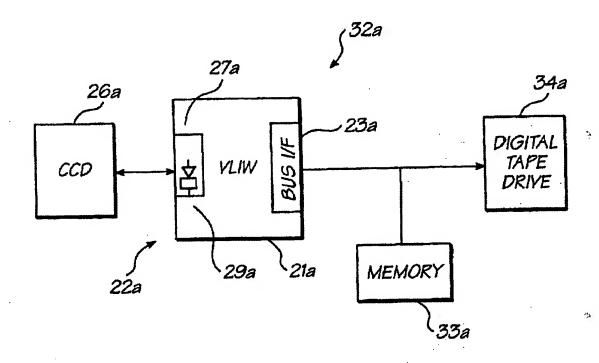
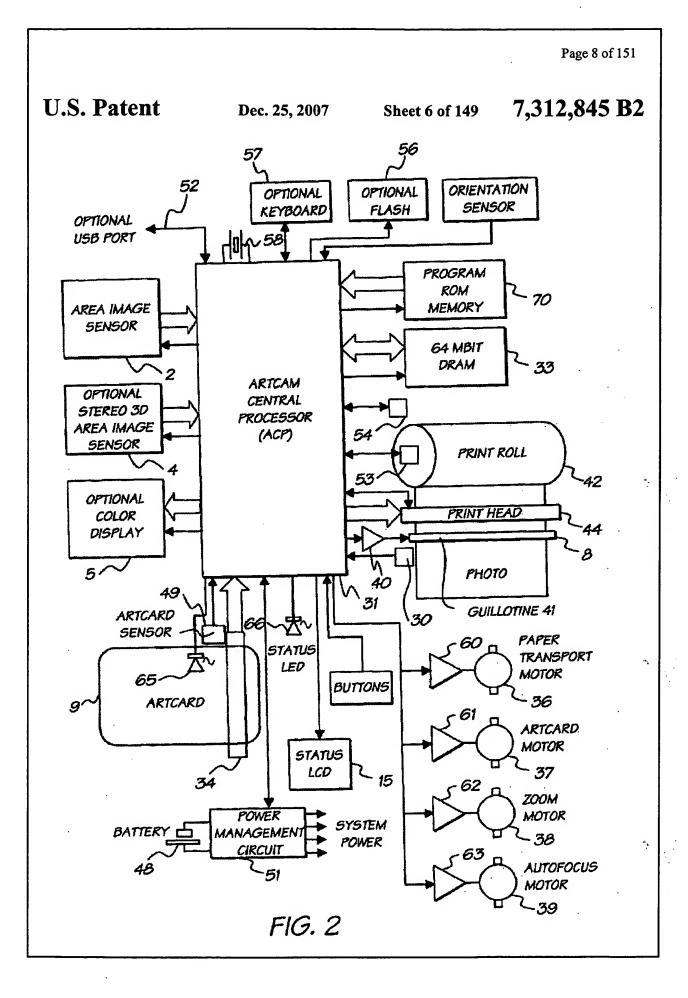


FIG. 1F



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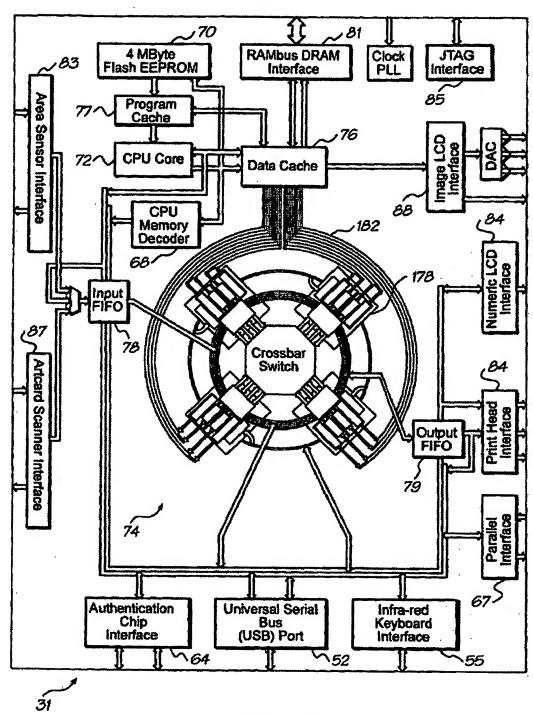


FIG. 3

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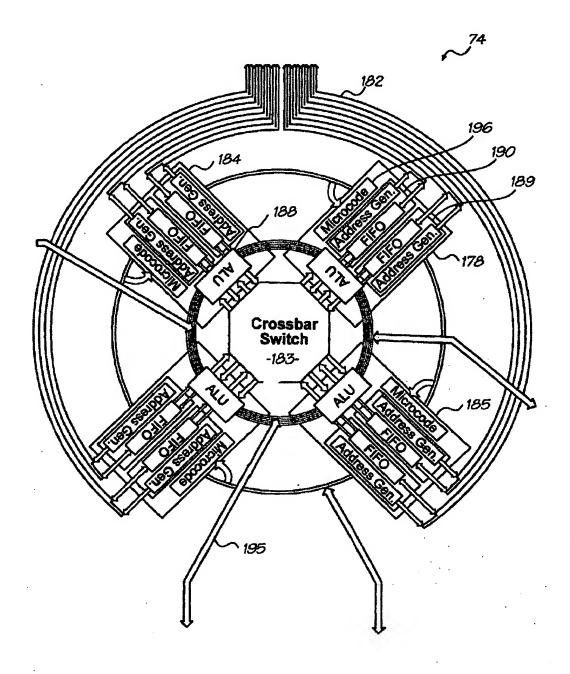
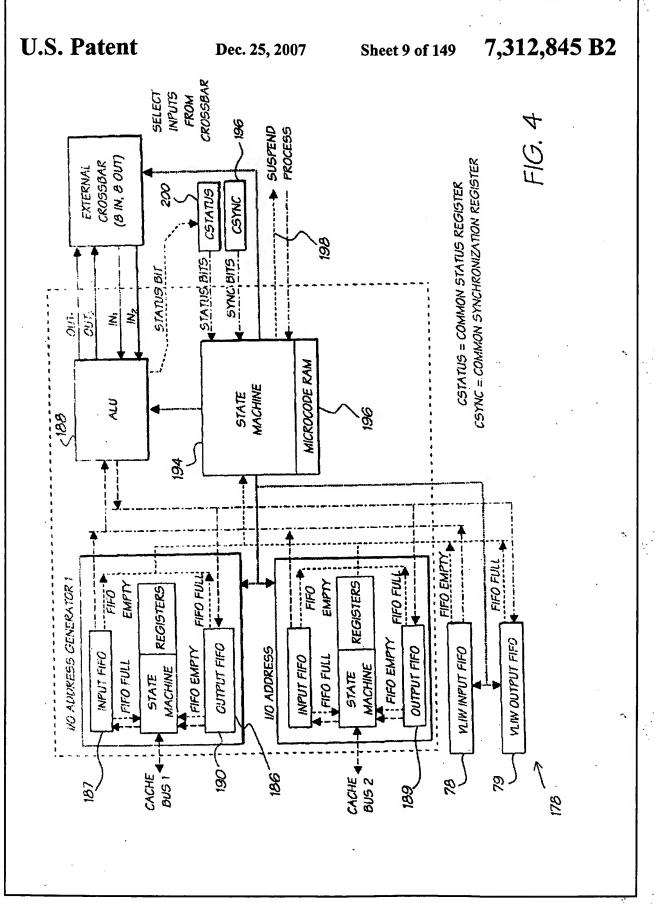


FIG. 3(a)



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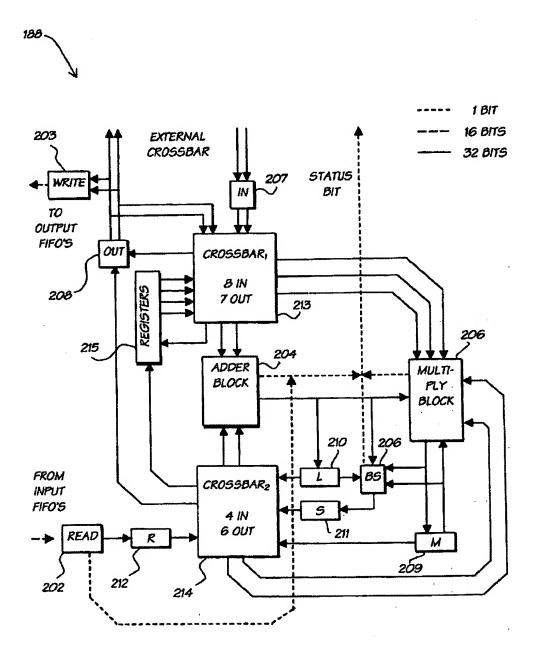


FIG. 5

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32 BITS CONTROL

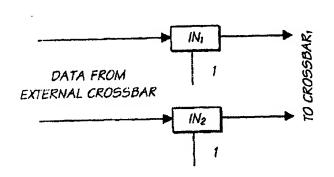


FIG. 6

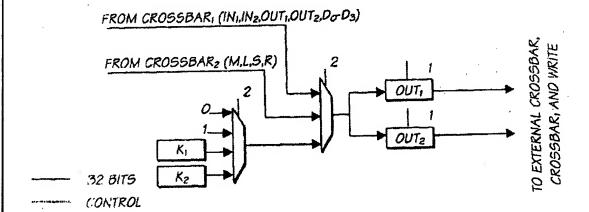


FIG. 7

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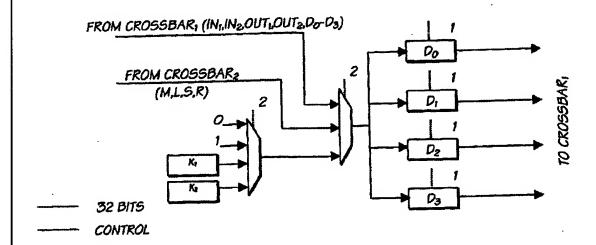


FIG. 8

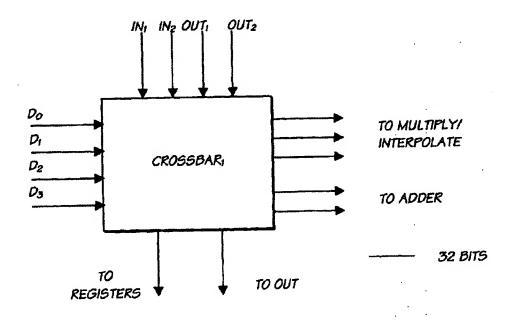


FIG. 9

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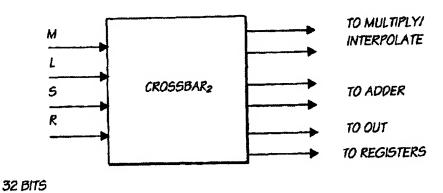


FIG. 10

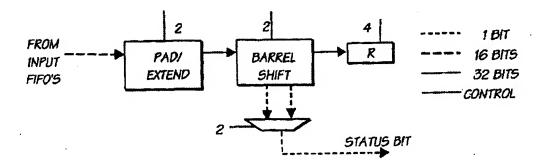


FIG. 11

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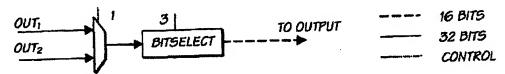


FIG. 12

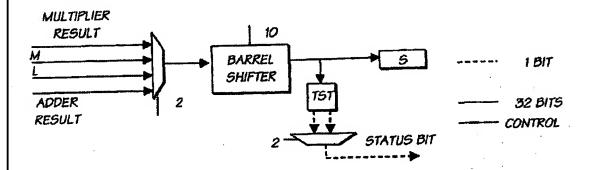


FIG. 13

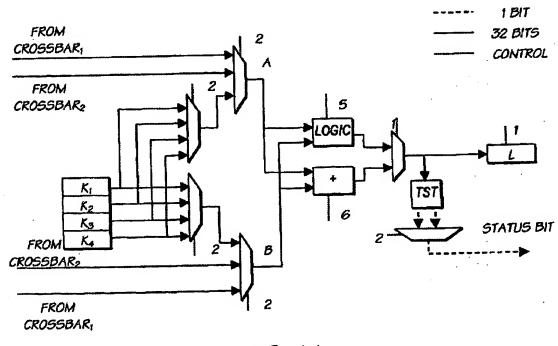


FIG. 14

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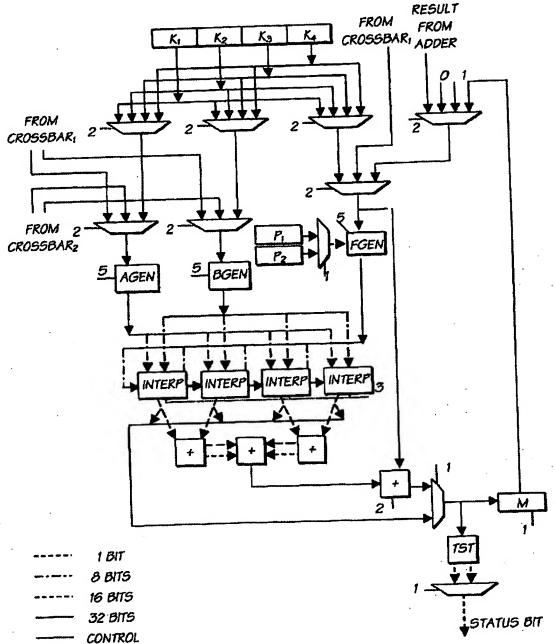


FIG. 15

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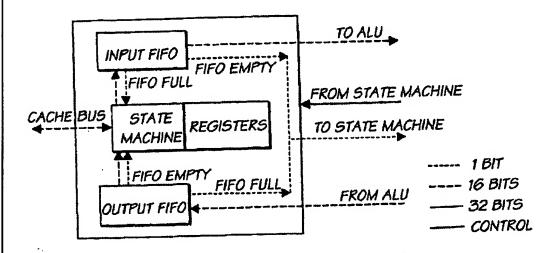


FIG. 16

ORDER OF PIXELS PRESENTED BY A SEQUENTIAL READ ITERATOR ON A 4 X 2 IMAGE WITH PADDING.

0	1	2	3
4	5	6	7

FIG. 17

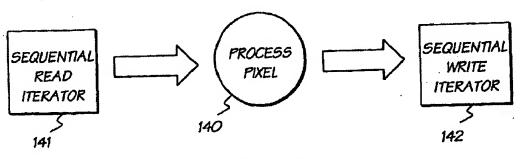


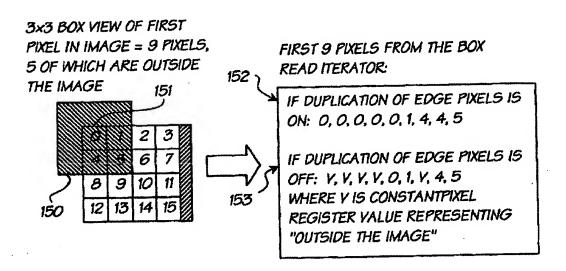
FIG. 18

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A 3x3 BOX VIEW TRAVERSES THE PIXELS IN ORDER: 0, 1, 2, 3, 4, 5, 6, 7, 8 ETC, PLACING A 3x3 BOX CENTERED OVER EACH PIXEL...



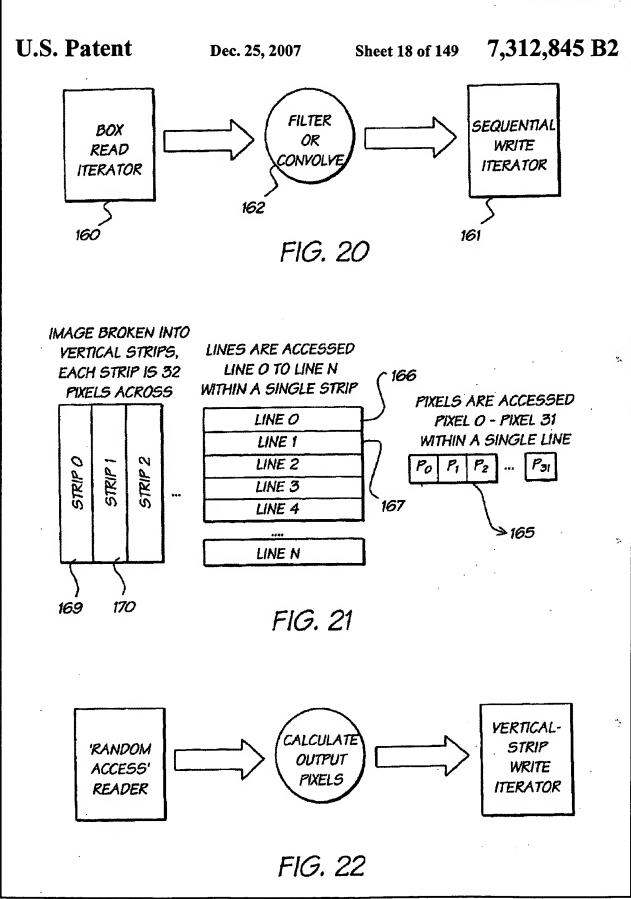
3x3 BOX VIEW OF SECOND PIXEL IN IMAGE = 9 PIXELS, 3 OF WHICH ARE OUTSIDE THE IMAGE

155 156 3 7 8 9 10 11 12 13 14 15 SECOND 9 PIXELS FROM THE BOX READ ITERATOR:

IF DUPLICATION OF EDGE PIXELS IS ON: 0, 1, 2, 0, 1, 2, 4, 5, 6

IF DUPLICATION OF EDGE PIXELS
IS OFF: V, V, V, O, 1, 2, 4, 5, 6
WHERE V IS CONSTANTPIXEL
REGISTER VALUE REPRESENTING
"OUTSIDE THE IMAGE"

FIG. 19





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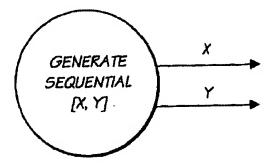
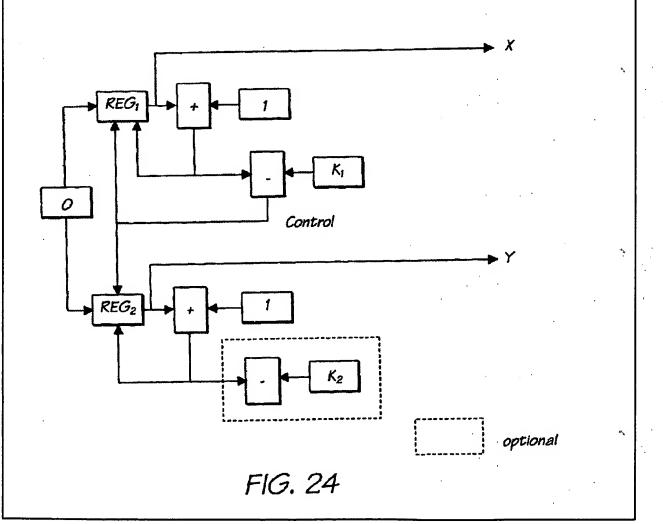


FIG. 23





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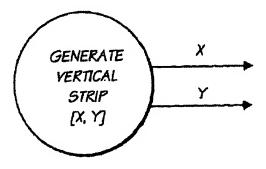


FIG. 25

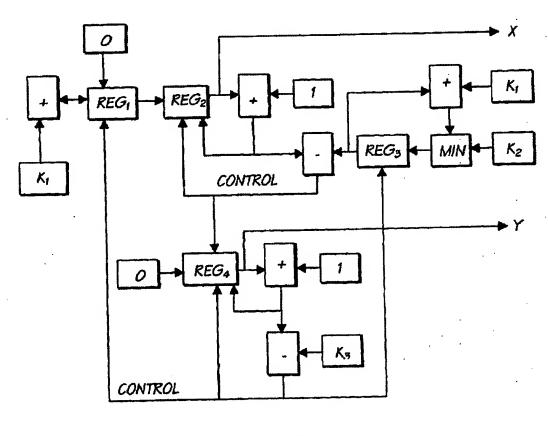


FIG. 26

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2X2 PIXEL BLOCK FROM SENSOR

FIG. 27

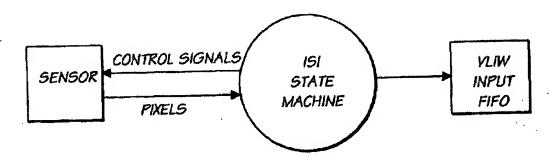


FIG. 28

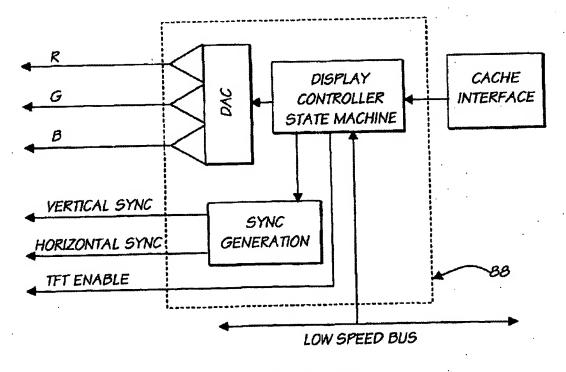


FIG. 29

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2X2 PIXEL BLOCK FROM CCD

FIG. 30

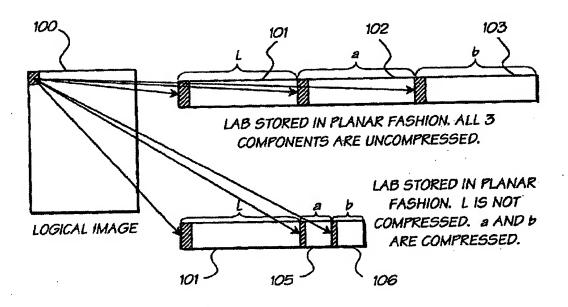


FIG. 31

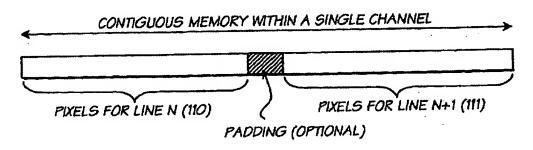


FIG. 32

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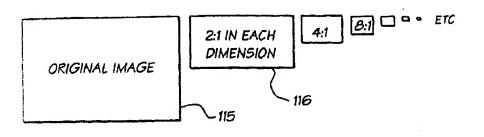


FIG. 33

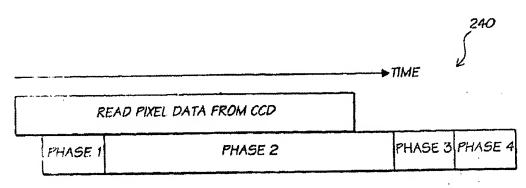


FIG. 34

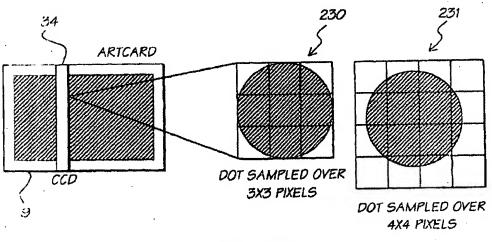
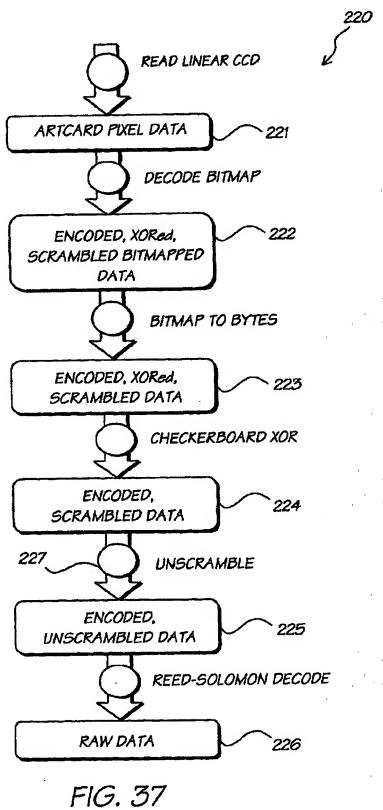
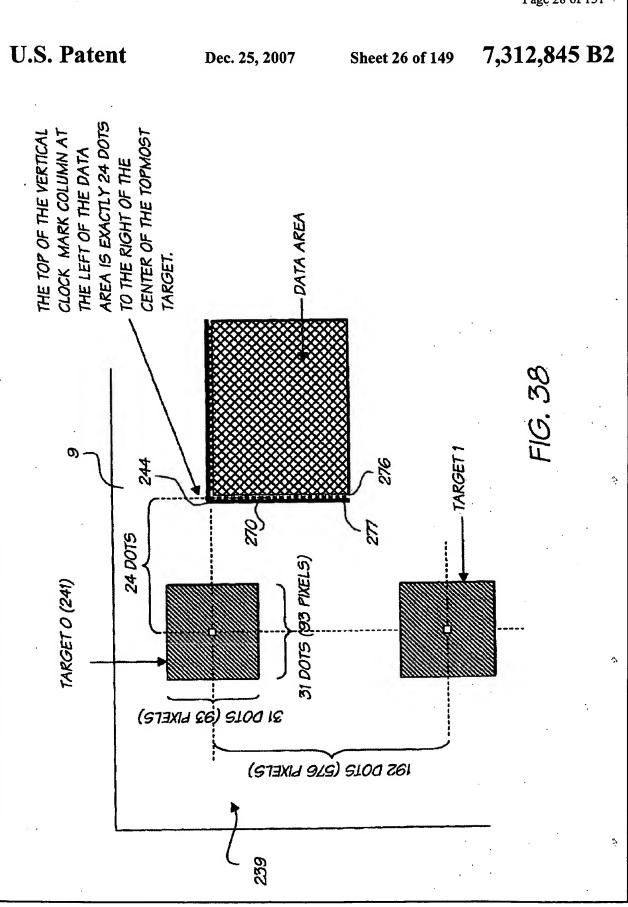


FIG. 35

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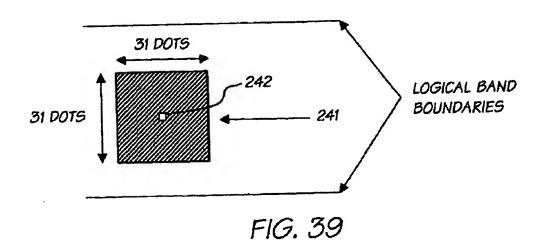


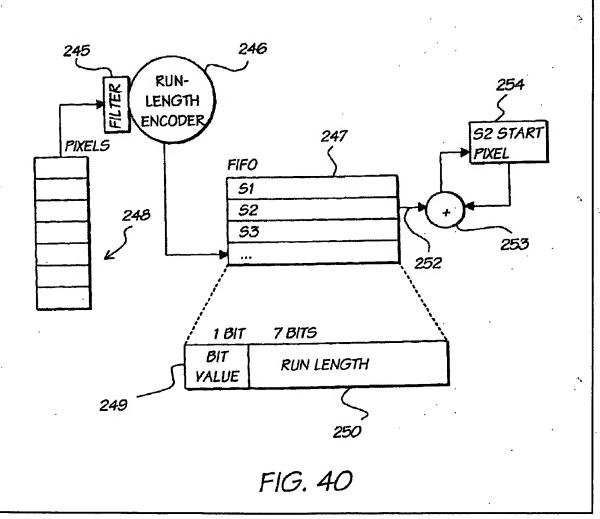




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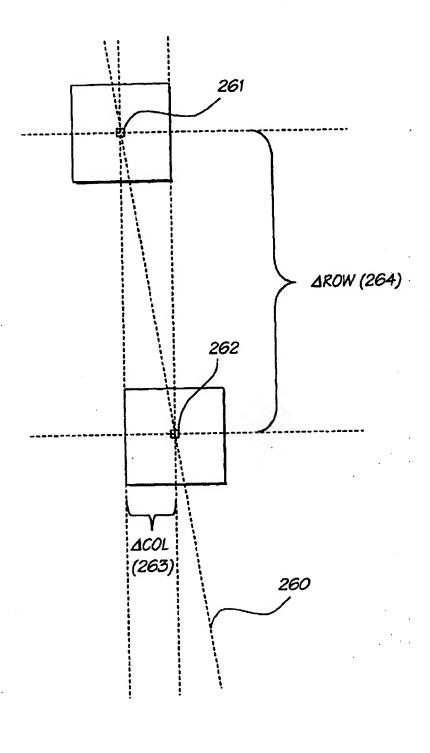


FIG. 41

Page 31 of 151 U.S. Patent 7,312,845 B2 **Sheet 29 of 149** Dec. 25, 2007 DOT YALUE (1 BIT) 300 302 30 LOOKUP TABLE PIXEL 3 (4 BITS) PIXEL 2 (4 BITS) PIXEL 1 (4 BITS) 163 290 292 293

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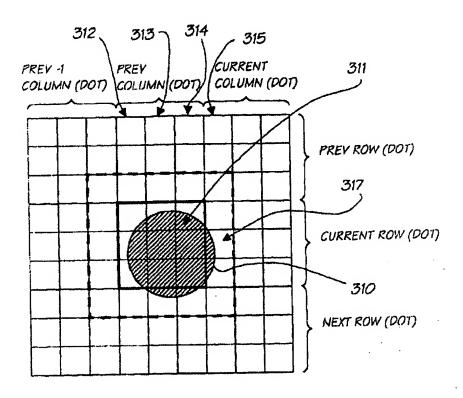


FIG. 44

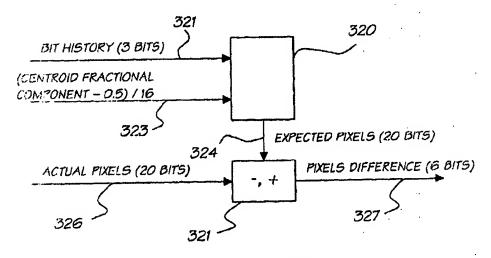
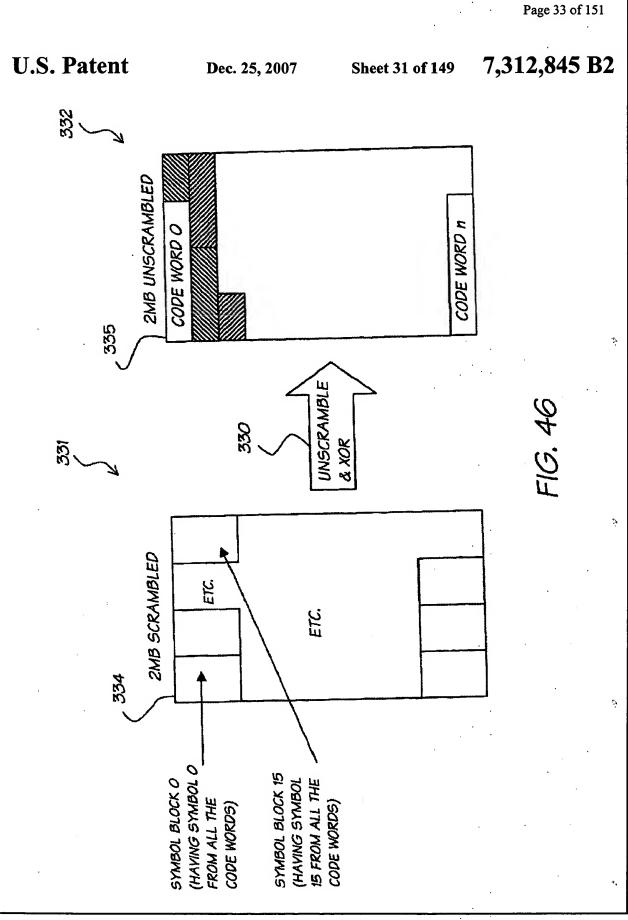
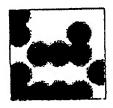


FIG. 45

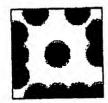


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BLACK AND WHITE



BLACK DOT SURROUNDED BY WHITE



WHITE DOT SURROUNDED BY BLACK

FIG. 47

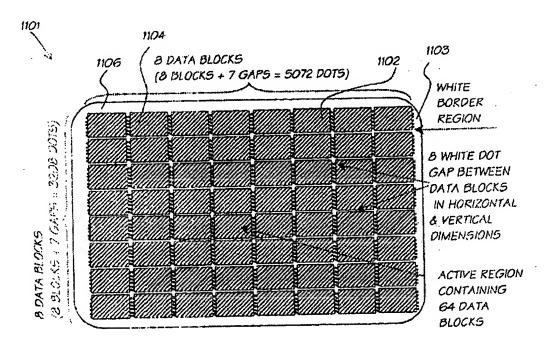
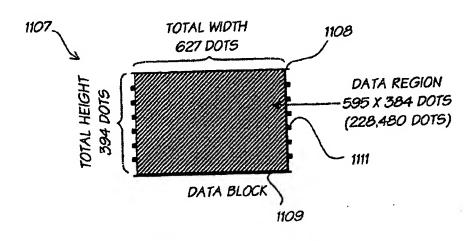


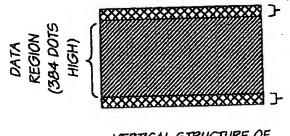
FIG. 48

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VERTICAL STRUCTURE OF DATA BLOCK UPPER BORDER & CLOCKMARKS (5 DOTS HIGH)

LOWER BORDER & CLOCKMARKS (5 DOTS HIGH)

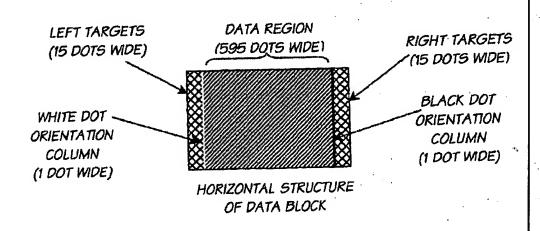


FIG. 49

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FIG. 52

UPPER LEFT CLOCKMARKS
AND BORDER

LOWER RIGHT CLOCKMARKS
AND BORDER

11114

11116

1107

FIG. 50

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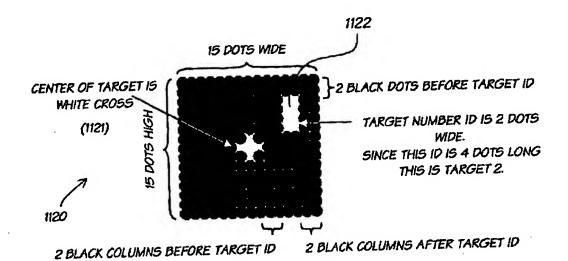
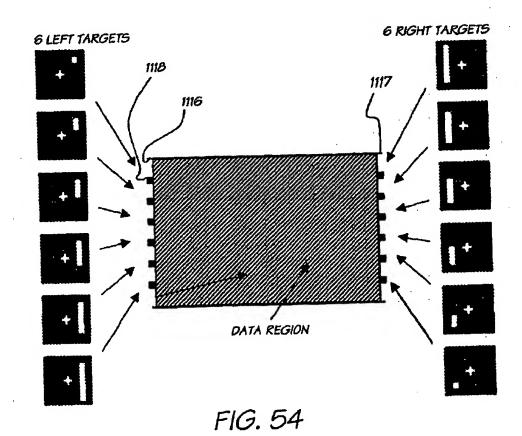
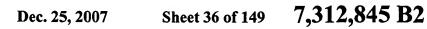


FIG. 53







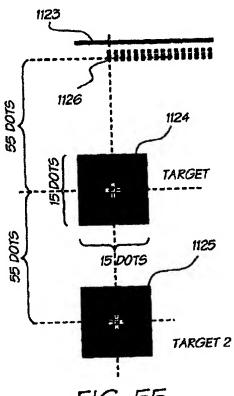
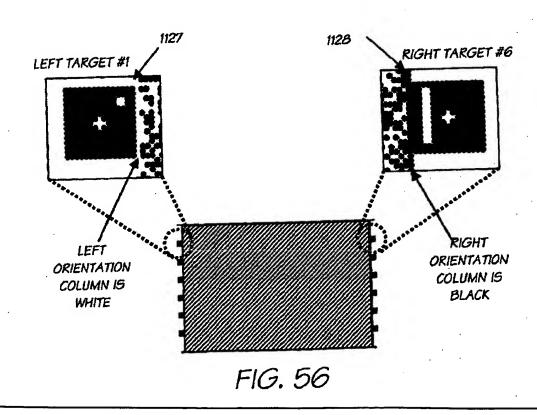


FIG. 55



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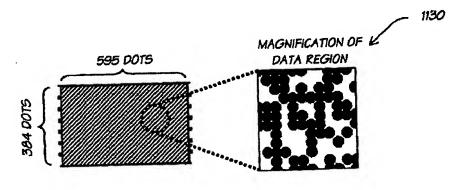


FIG. 57

CONTROL CONTROL

DATA BLOCK 1 DATA BLOCK 2

DATA BLOCK N

DATA BLOCK 1 DATA BLOCK 2

DATA BLOCK N

DATA BLOCK N

DATA BLOCK N

DATA BLOCK N

2 CONTROL BLOCKS

N REED-SOLOMON BLOCKS, ENCODING THE FIRST COPY OF THE DATA.

N REED-SOLOMON BLOCKS, ENCODING THE SECOND COPY OF THE DATA.

OTHER COPIES OF THE DATA (NOT SHOWN) EACH COPY IS N BLOCKS.

FINAL COPY OF DATA - THERE IS ONLY ENOUGH SPACE FOR FIRST 2 OF THE N BLOCKS.

FIG. 58

00: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D OC: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D 18: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D 32 COPIES OF THE 24: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D 3 BYTE CONTROL 30: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D 3C: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D INFORMATION 48: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D 54: 4F 00 3D 4F 00 3D 4F 00 3D 4F 00 3D 60: 00 00 00 00 00 00 00 00 00 00 00 RESERVED 6C: 00 00 00 00 00 00 00 00 00 00 00 00 BYTES ARE O 78: 00 00 00 00 00 00 00 00 00 00 00

FIG. 59

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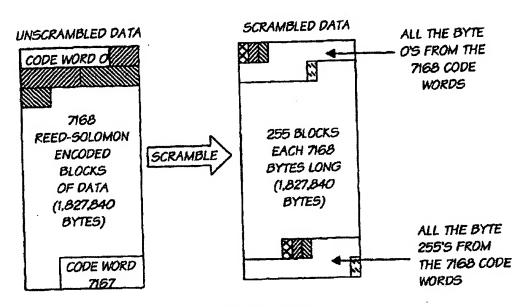


FIG. 60

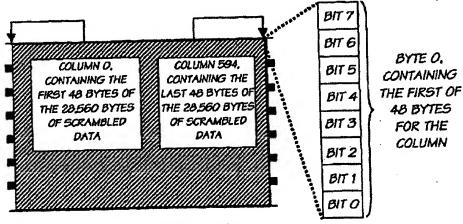


FIG. 61

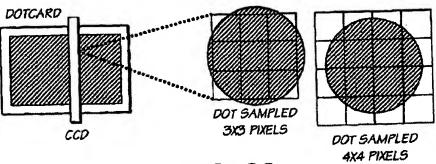
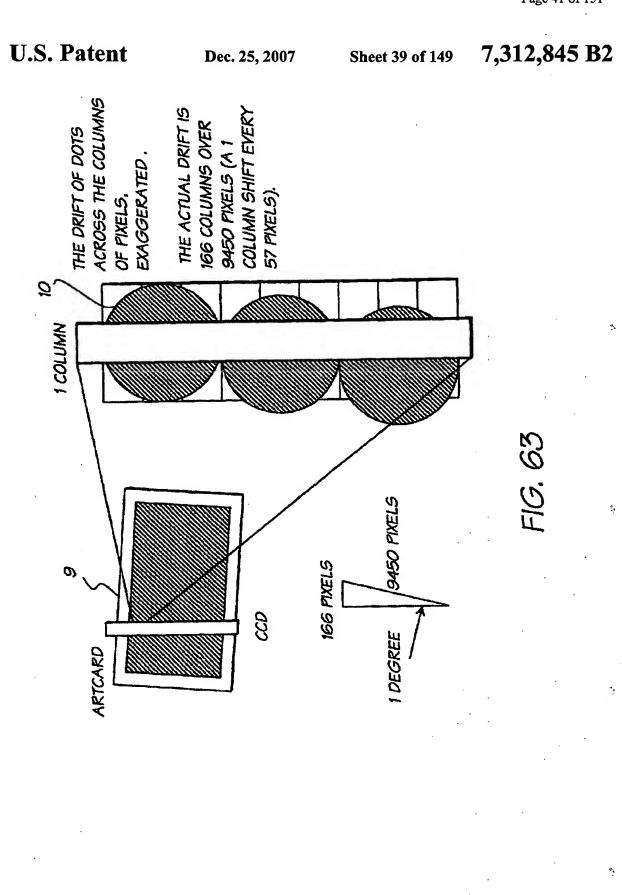
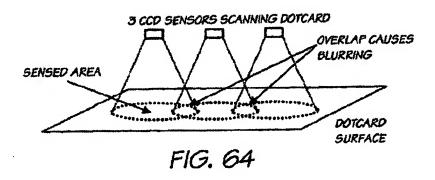


FIG. 62

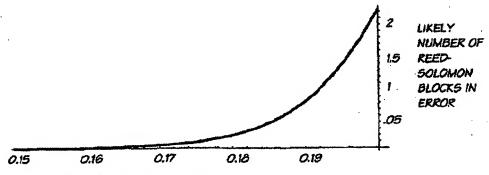


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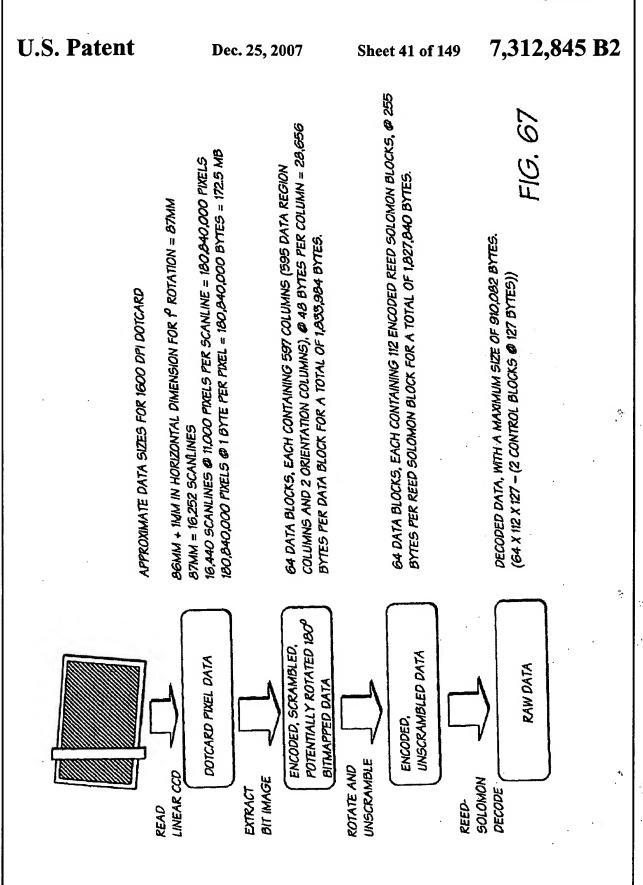
RANGE OF BLACK DOTS (FREQUENCY DISTRIBUTION) RANGE OF WHITE DOTS (FREQUENCY DISTRIBUTION) 40 30 20 10 50 100 150 200 CENTER DOT PIXEL YALUE

FIG. 65



PROBABILITY OF A SYMBOL BEING IN ERROR DURING A READ

FIG. 66



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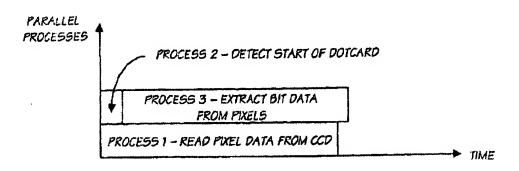


FIG. 68

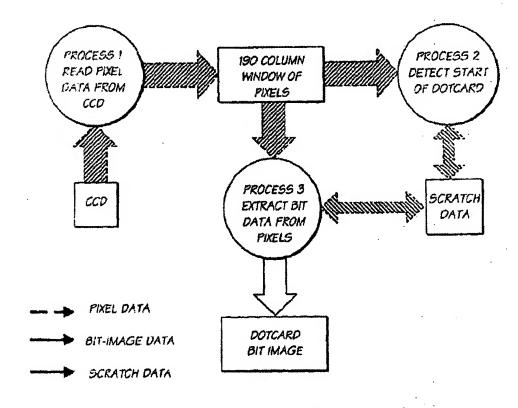


FIG. 69

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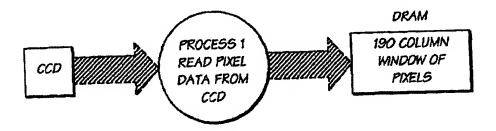


FIG. 70

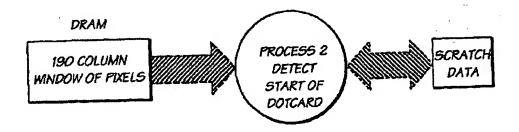


FIG. 71

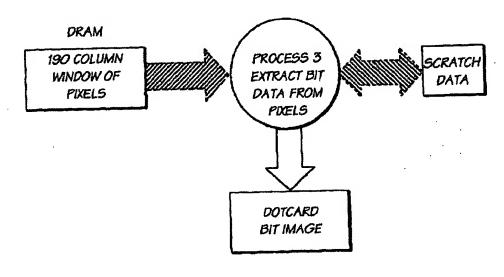


FIG. 72

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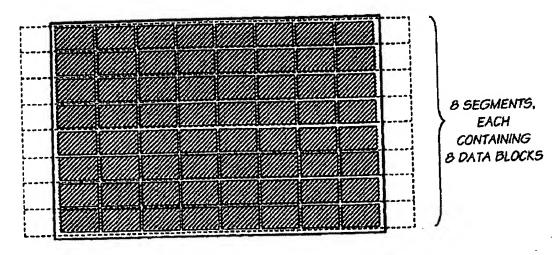


FIG. 73

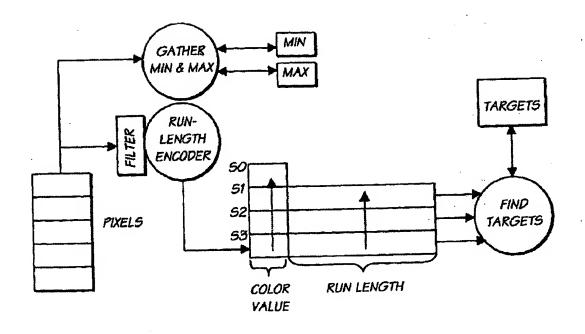


FIG. 74

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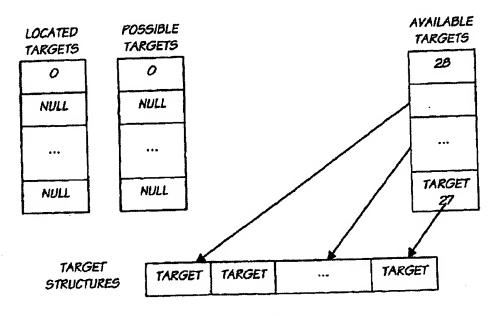


FIG. 75

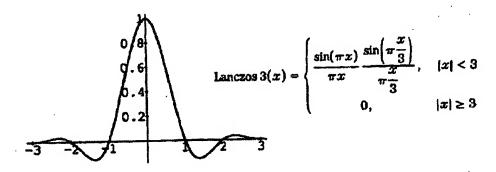


FIG. 76

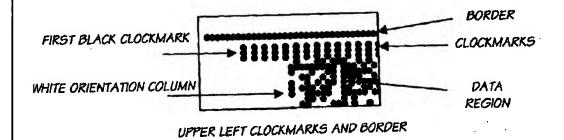


FIG. 77

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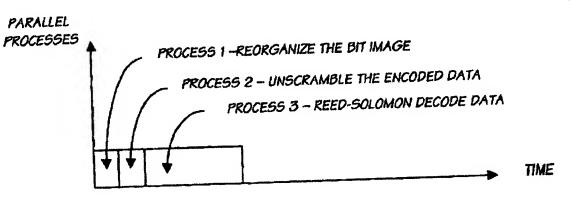
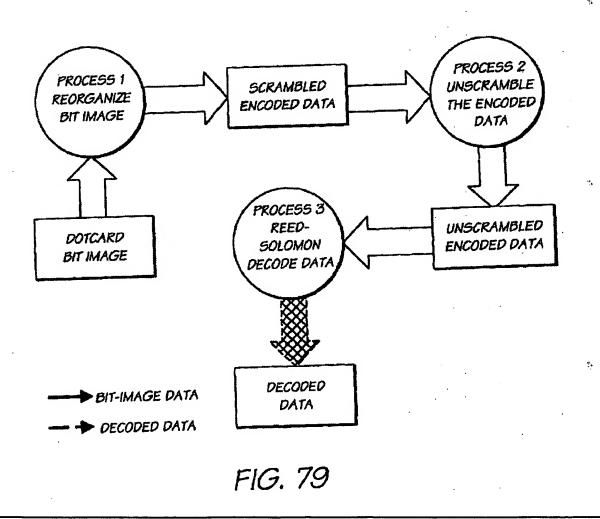


FIG. 78



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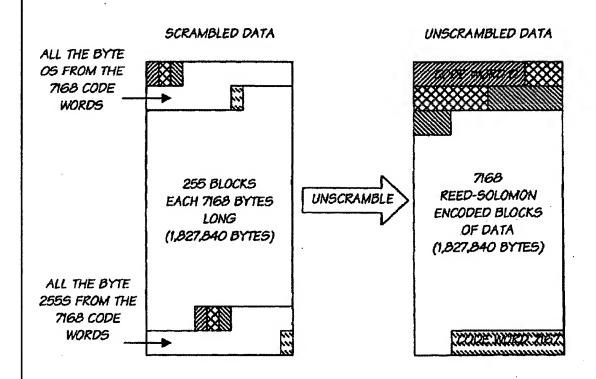


FIG. 80

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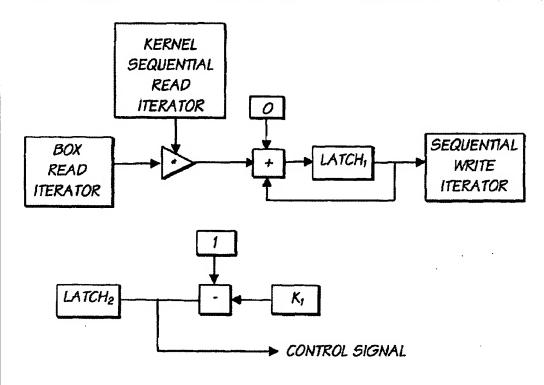
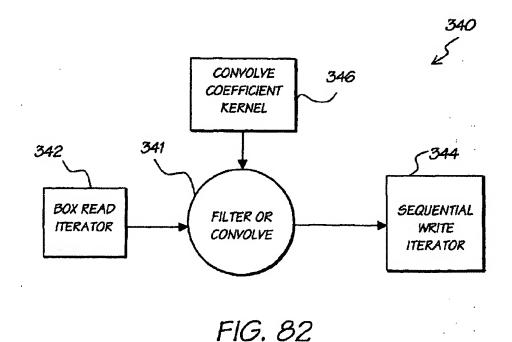


FIG. 81



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7,312,845 B2_a

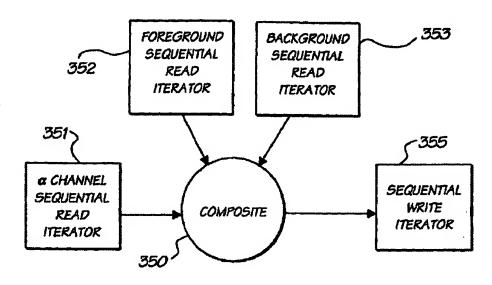


FIG. 83

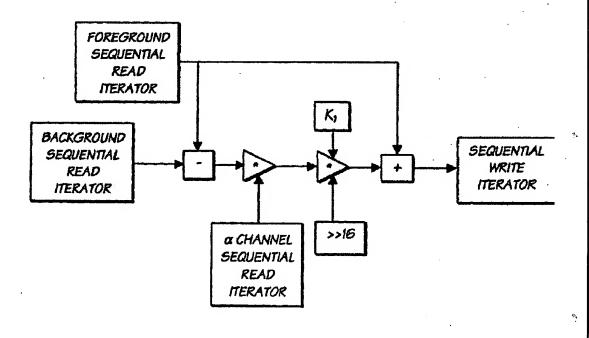


FIG. 84

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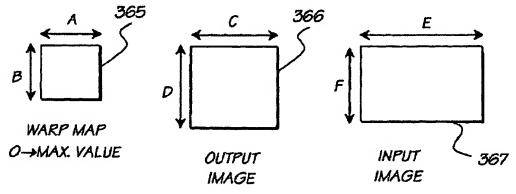


FIG. 85

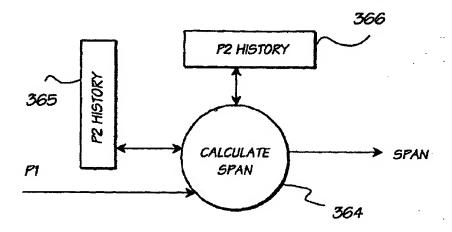


FIG. 86

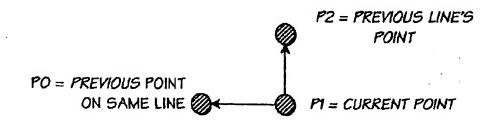


FIG. 88

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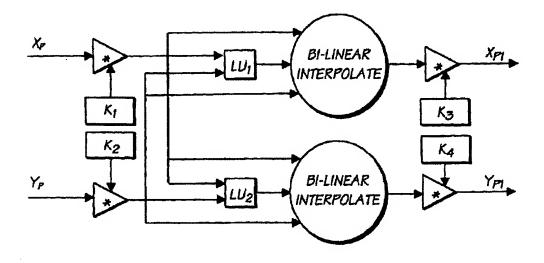


FIG. 87

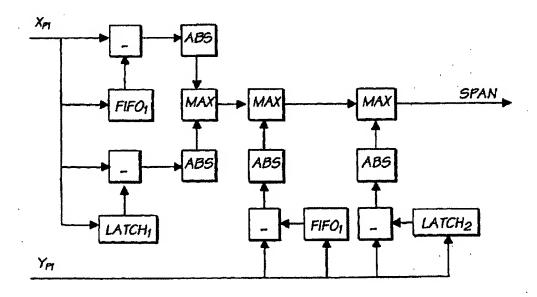


FIG. 89

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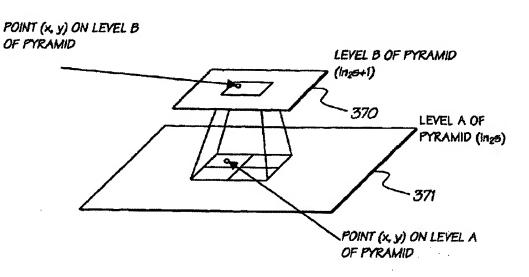


FIG. 90

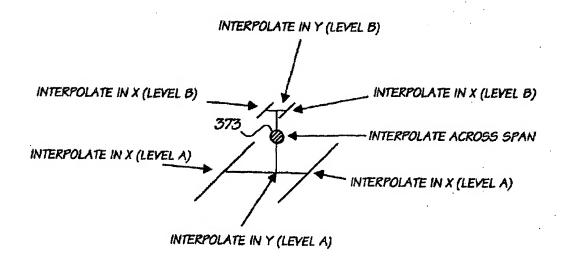


FIG. 91

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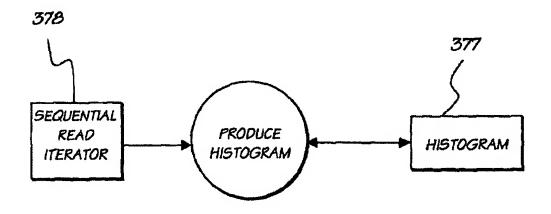
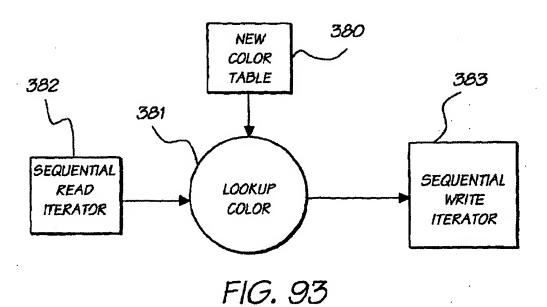


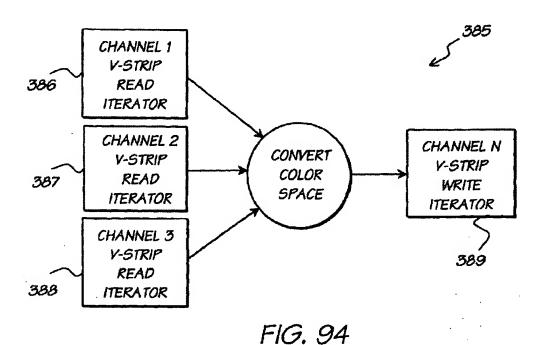
FIG. 92

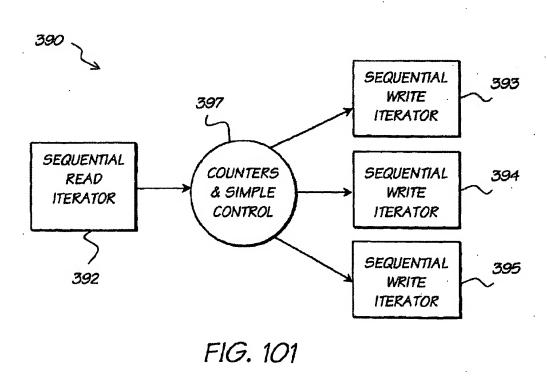




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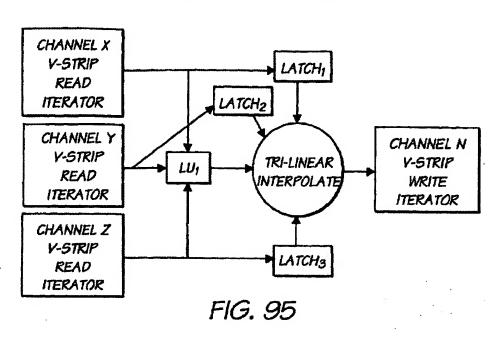
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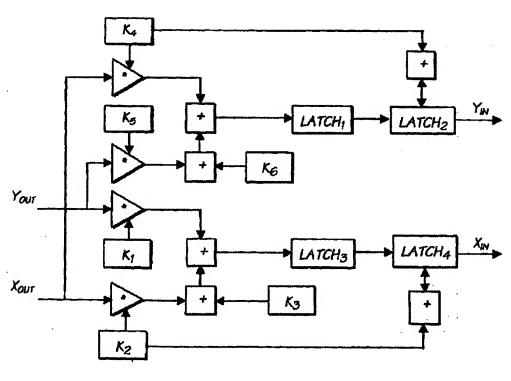


FIG. 96

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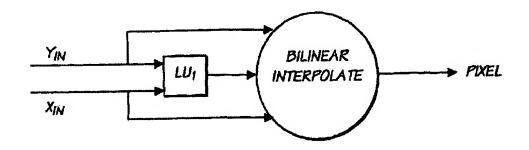


FIG. 97

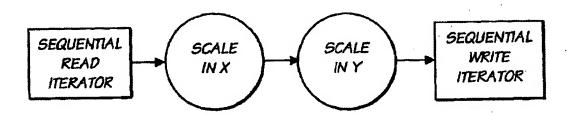


FIG. 98

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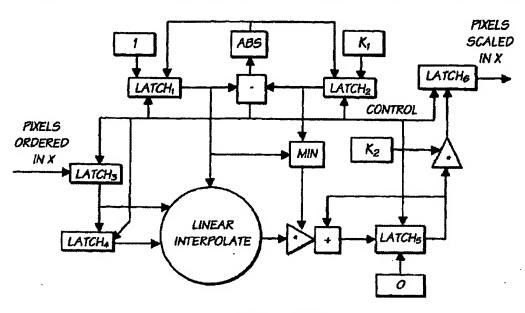


FIG. 99

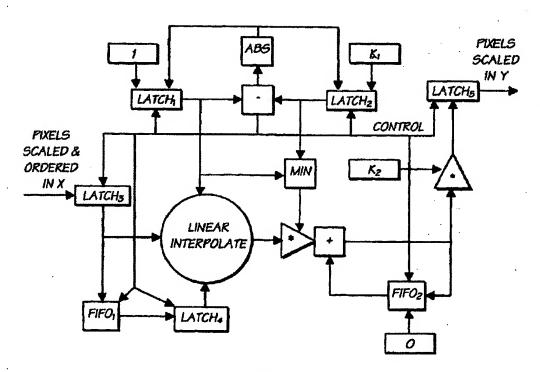
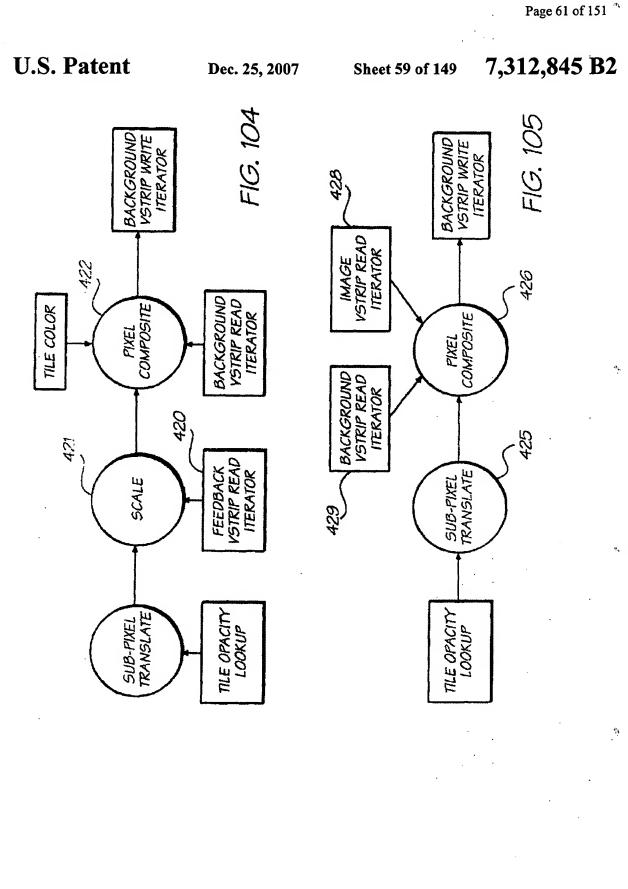
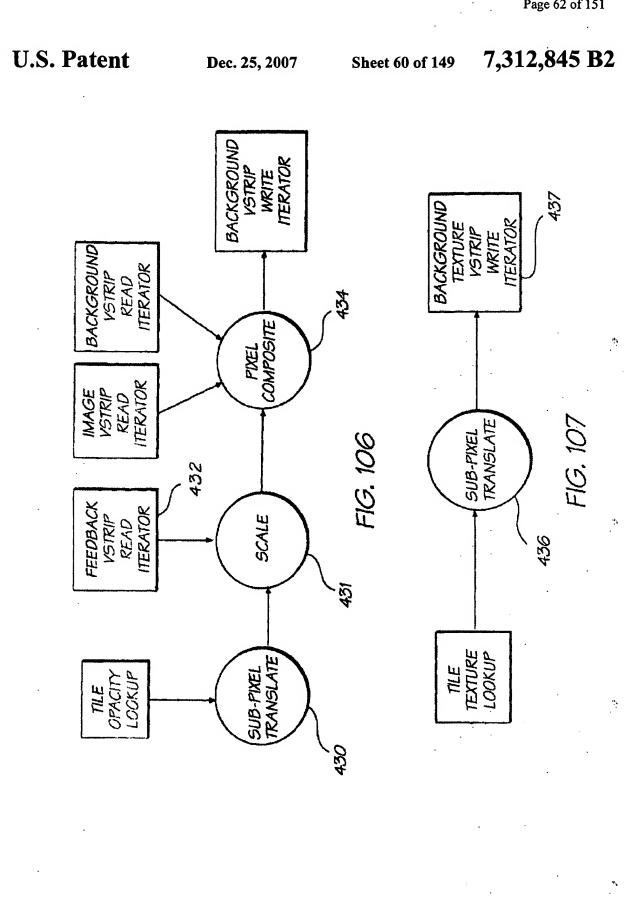
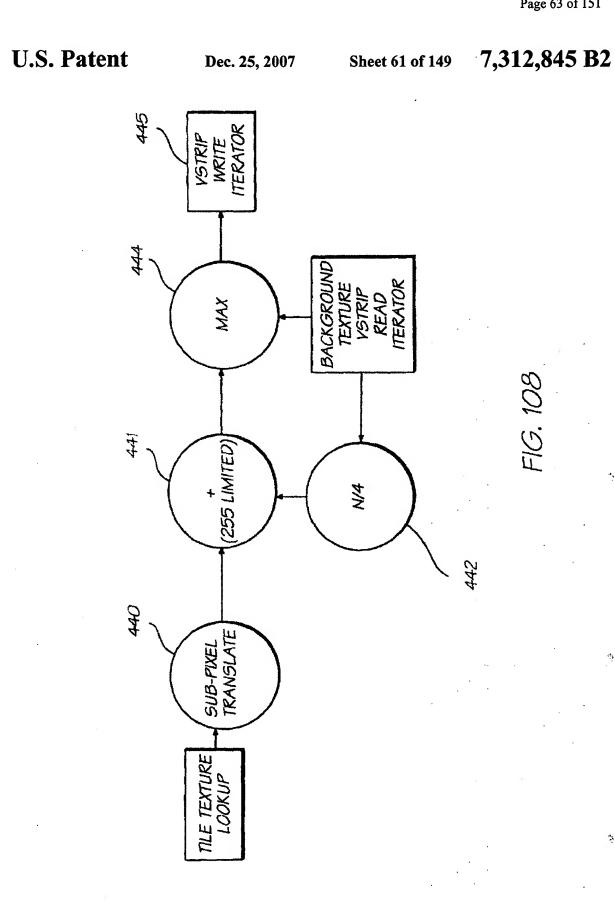


FIG. 100



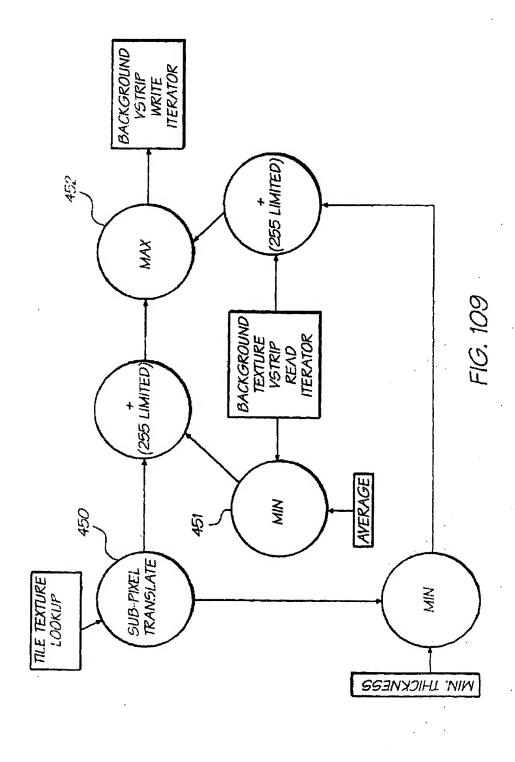


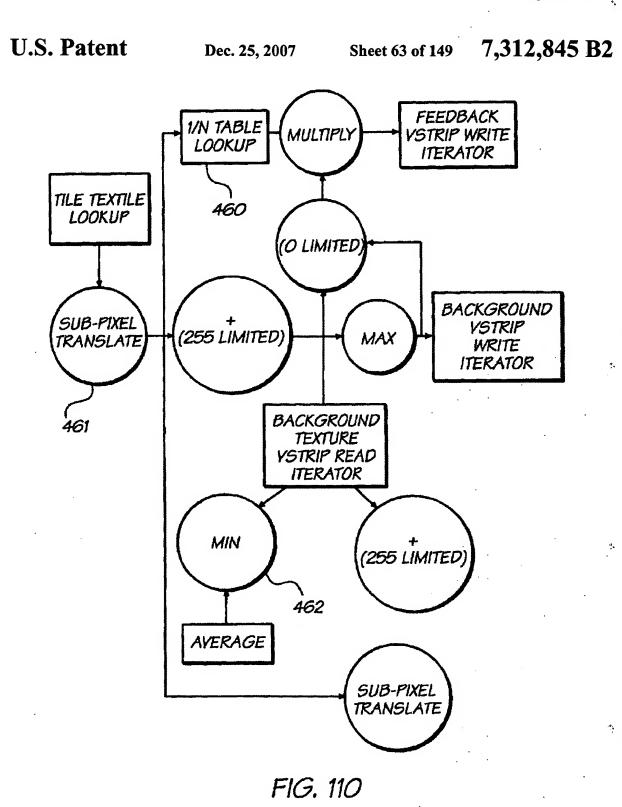


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2X2 PIXEL BLOCK, O DEGREES



2X2 PIXEL BLOCK, 90 DEGREES

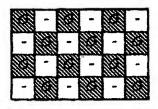


2X2 PIXEL BLOCK, 180 DEGREES



2X2 PIXEL BLOCK, 270 DEGREES

FIG. 111

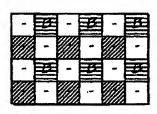


LINEAR INTERPOLATED PIXELS



ACTUAL PIXELS (NOT INTERPOLATED)

FIG. 112



- LINEAR INTERPOLATED PIXELS

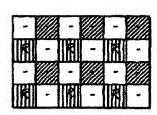


BI-LINEAR INTERPOLATED PIXELS



ACTUAL PIXELS (NOT INTERPOLATED)

FIG. 113



- LINEAR INTERPOLATED PIXELS

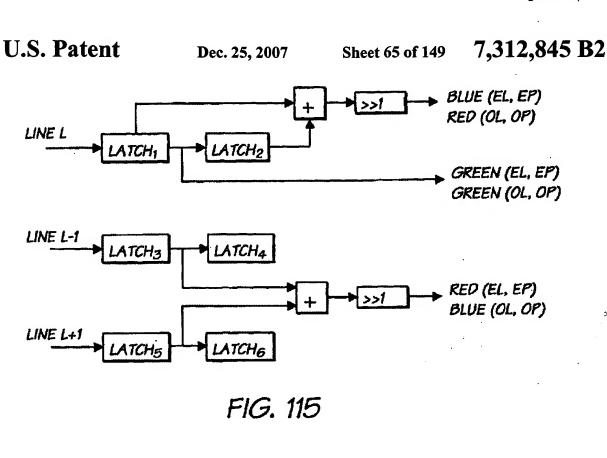


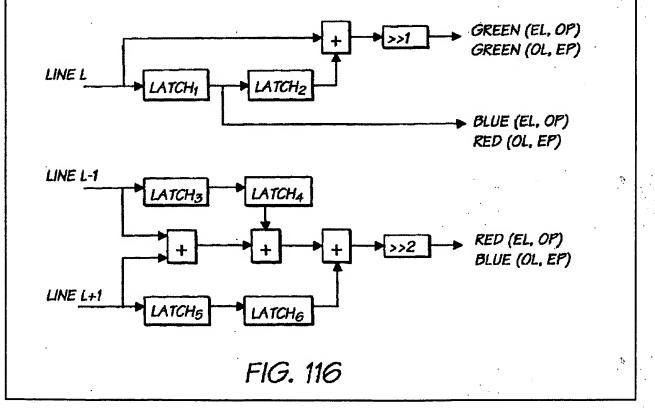
BI-LINEAR INTERPOLATED PIXELS

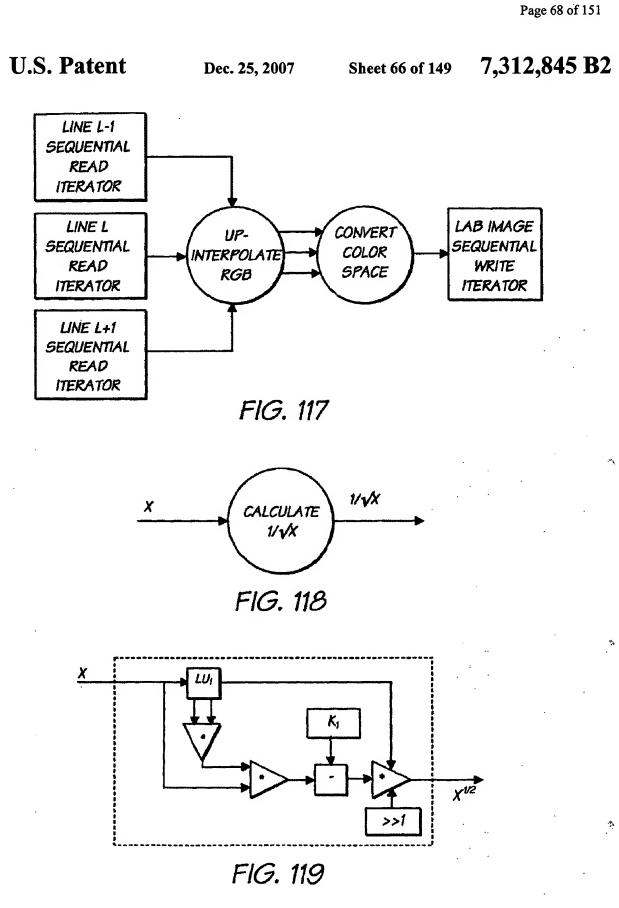


ACTUAL PIXELS (NOT INTERPOLATED)

FIG. 114







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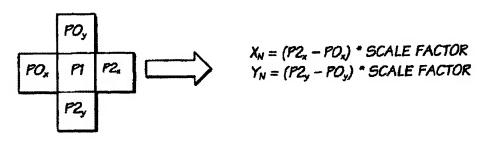


FIG. 120

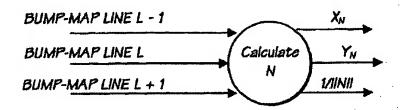


FIG. 121

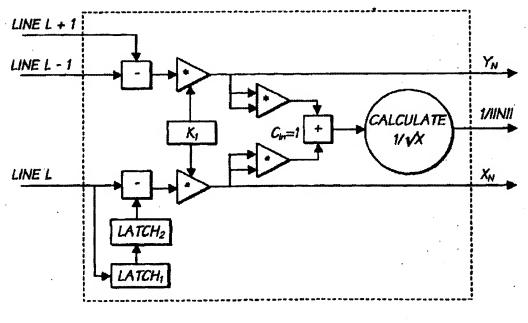
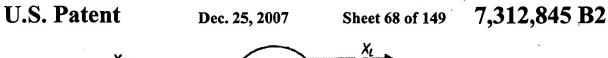


FIG. 122



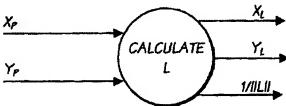


FIG. 123

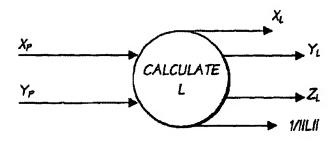
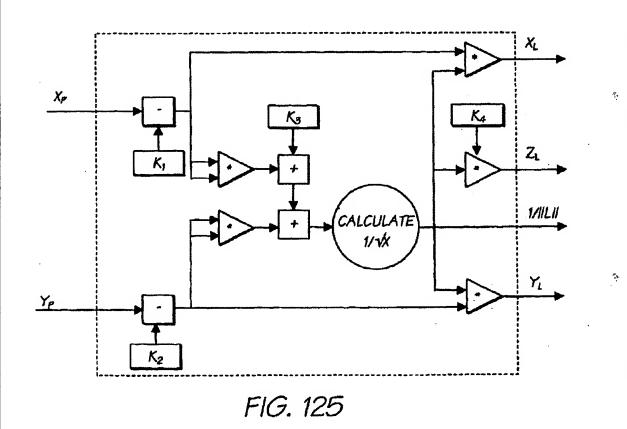


FIG. 124





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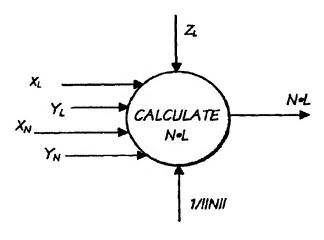


FIG. 126

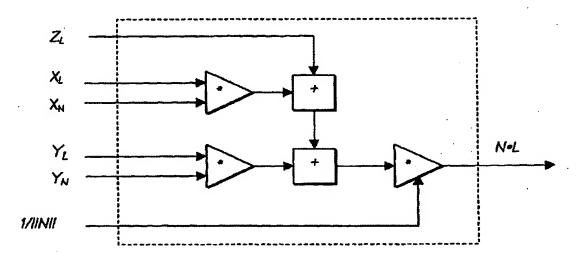


FIG. 127

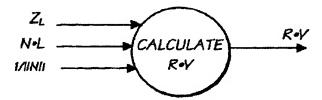


FIG. 128

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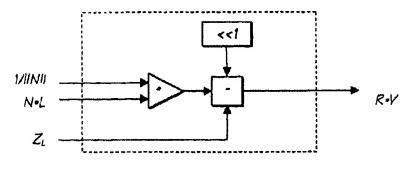


FIG. 129

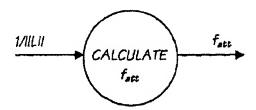
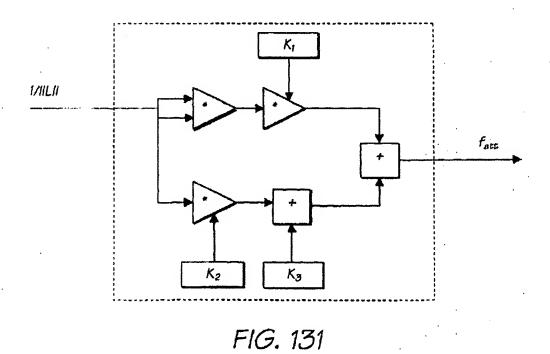


FIG. 130





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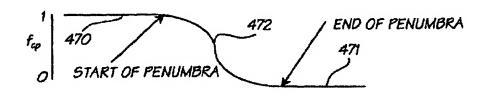
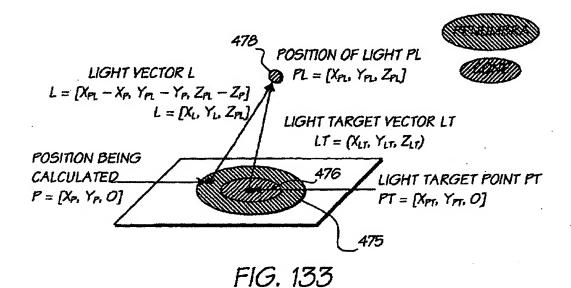


FIG. 132



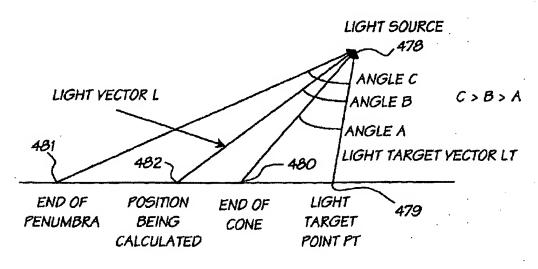


FIG. 134

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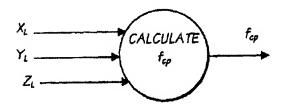


FIG. 135

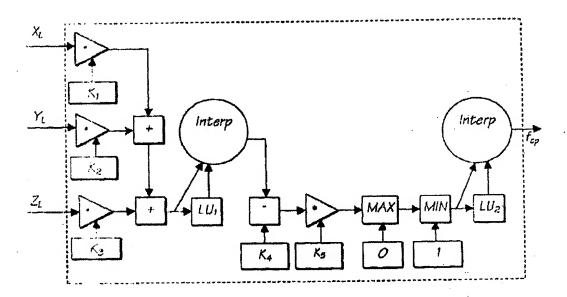


FIG. 136

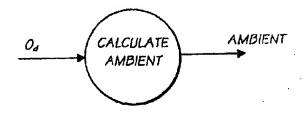


FIG. 137

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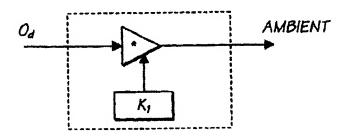


FIG. 138

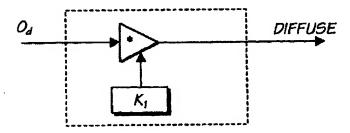


FIG. 139

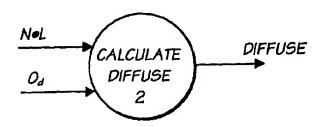


FIG. 140

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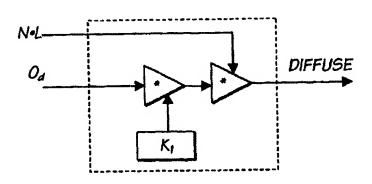


FIG. 141

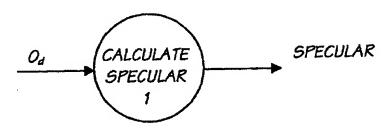


FIG. 142

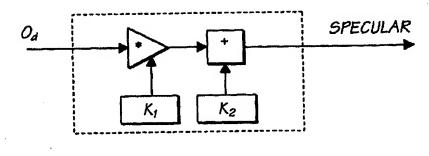


FIG. 143

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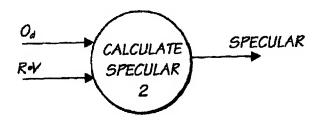


FIG. 144

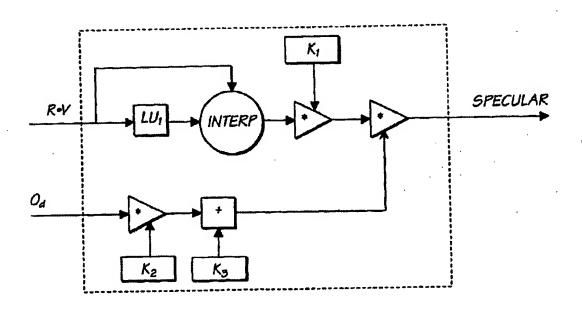


FIG. 145

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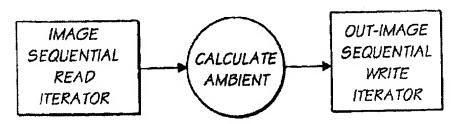


FIG. 146

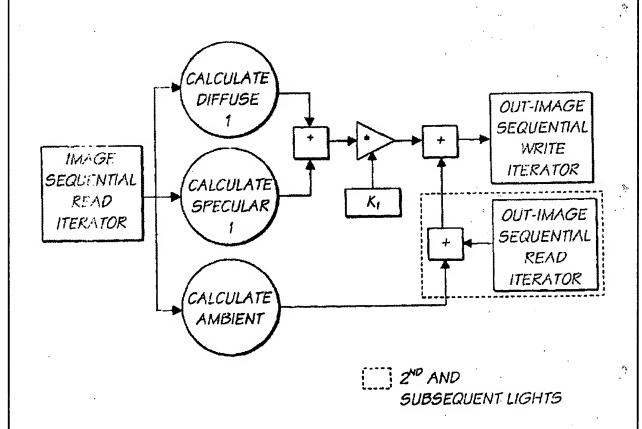


FIG. 147

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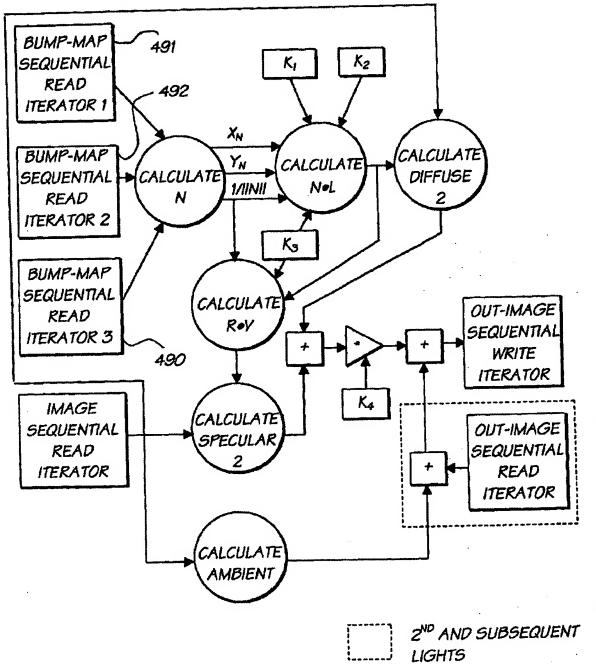


FIG. 148

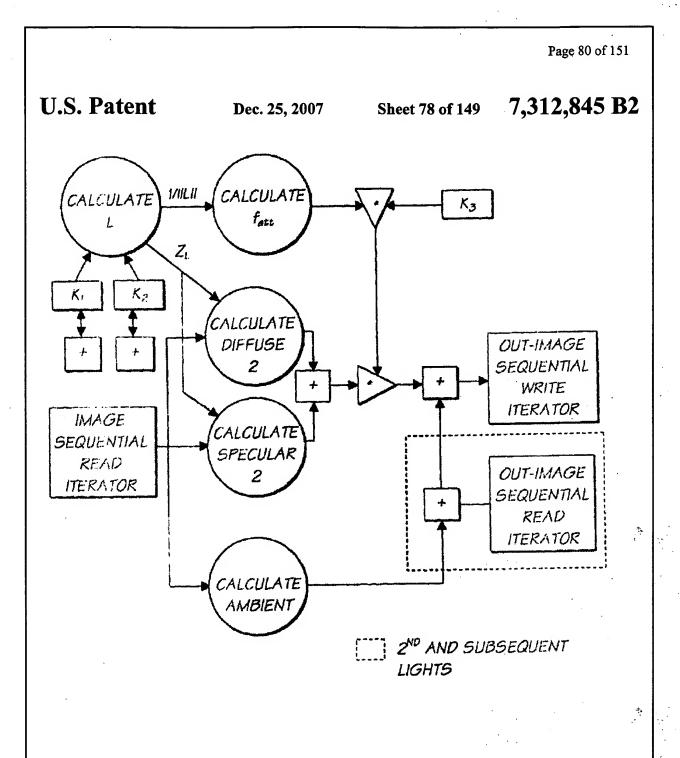


FIG. 149

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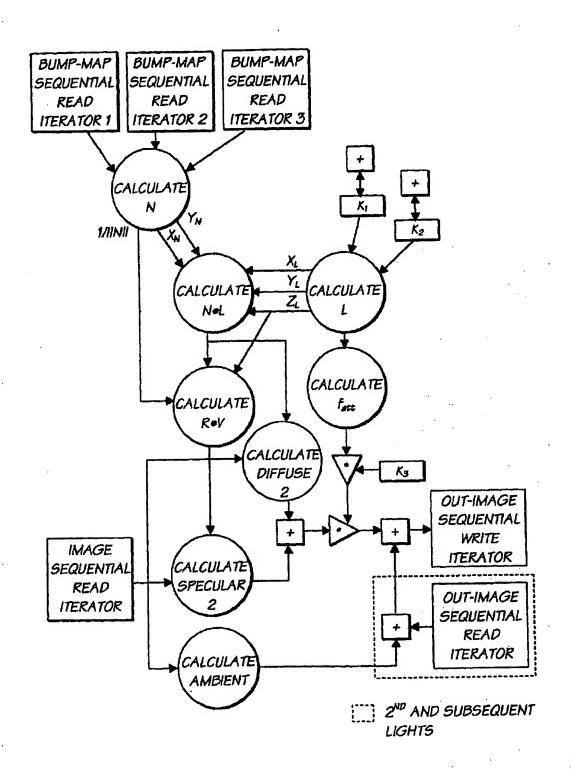


FIG. 150

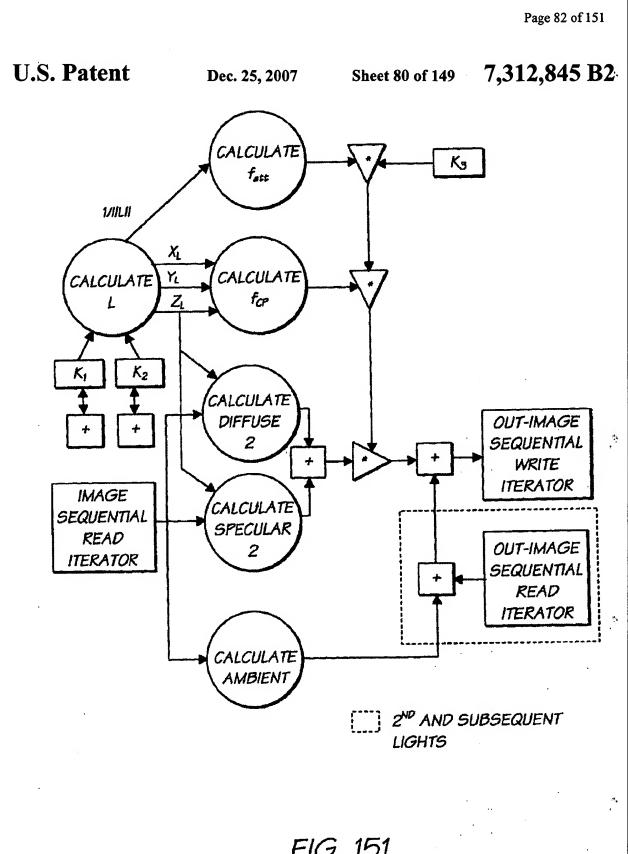


FIG. 151

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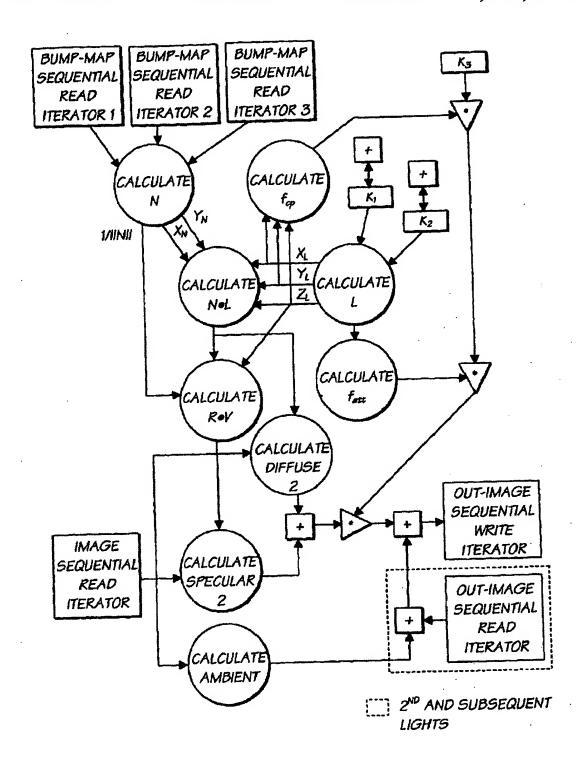
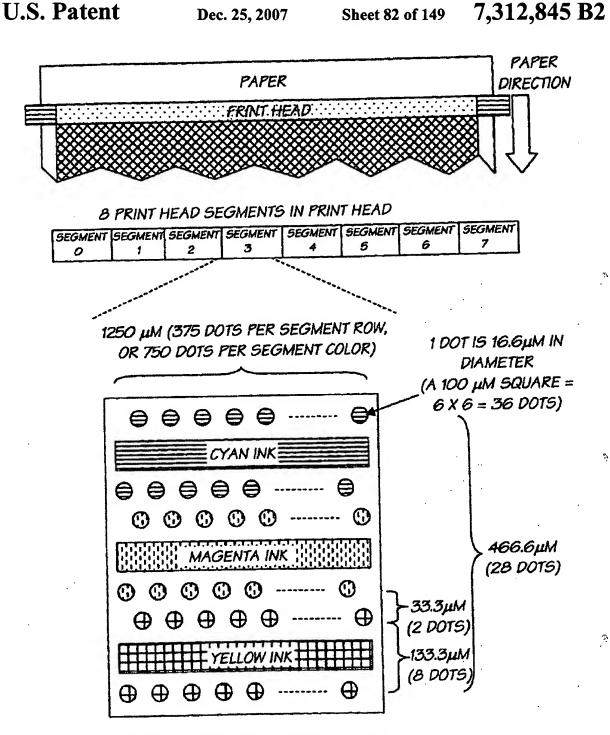
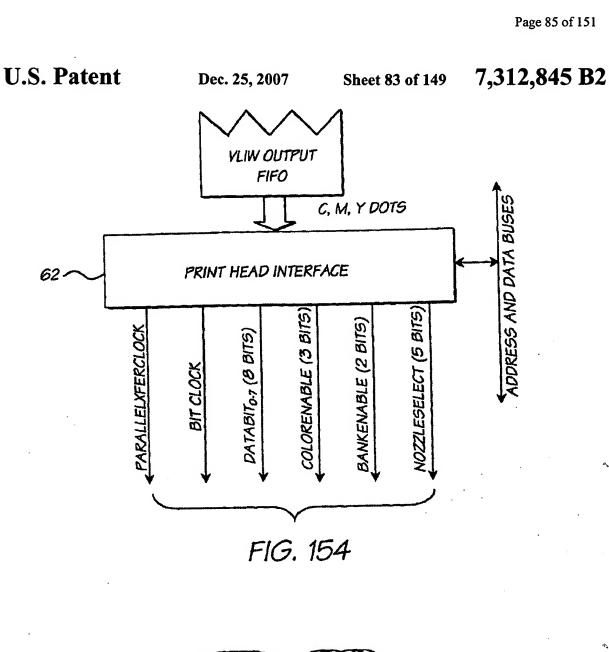


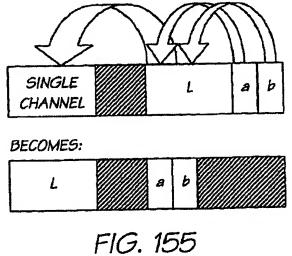
FIG. 152



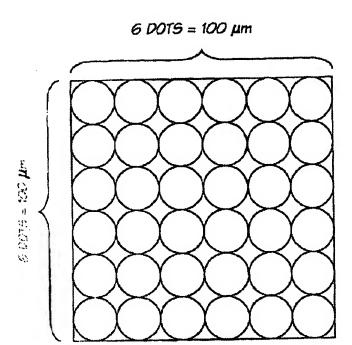
EACH SEGMENT CONTAINS 6 ROWS OF DOTS: ODD AND EVEN CYAN, MAGENTA, AND YELLOW.

FIG. 153





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1 PIXEL = 6 X 6 DOTS = 36 DOTS = 100 µm SQUARE

FIG. 156

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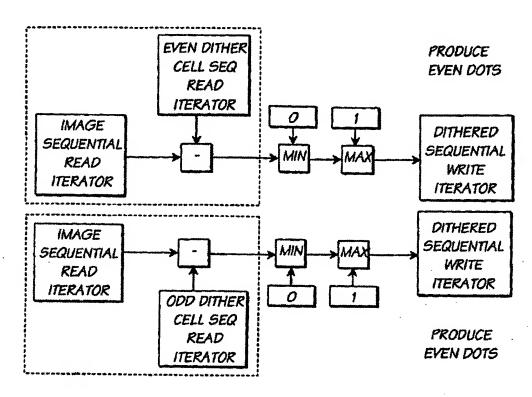


FIG. 157

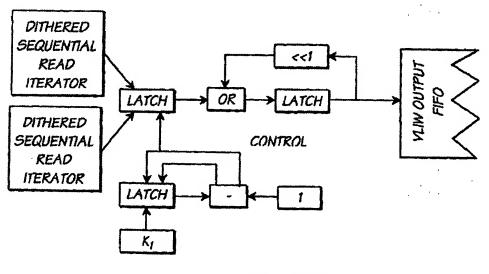
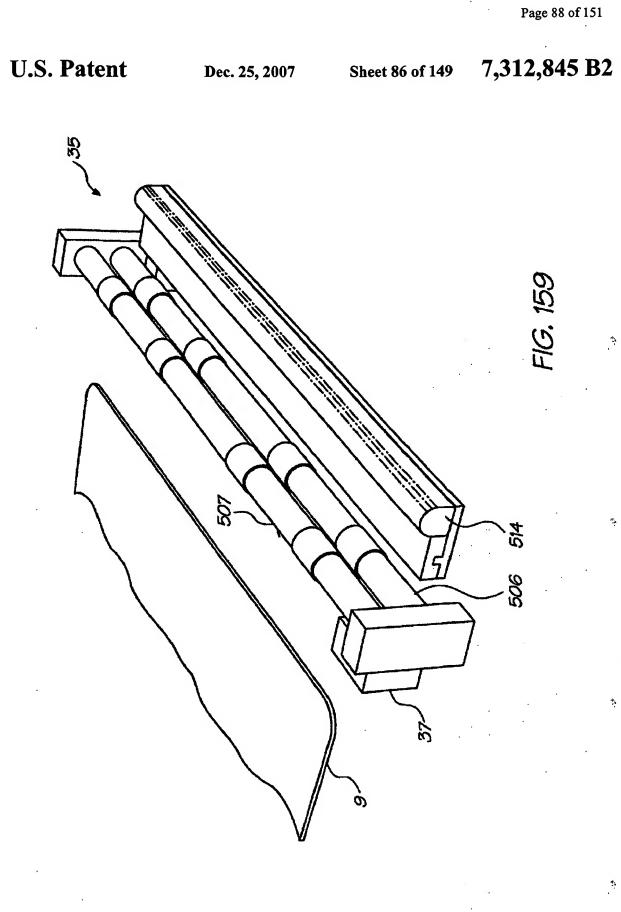
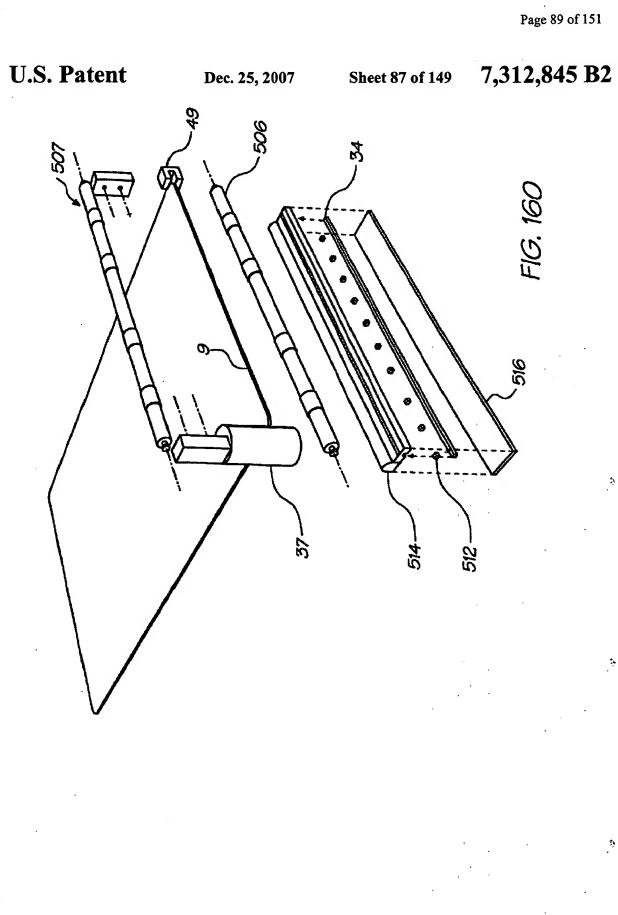
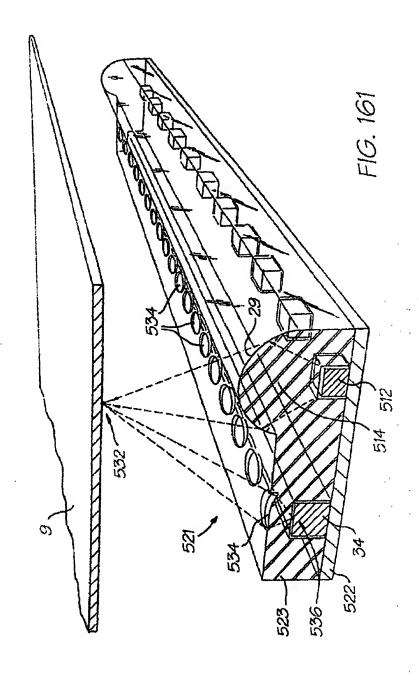


FIG. 158

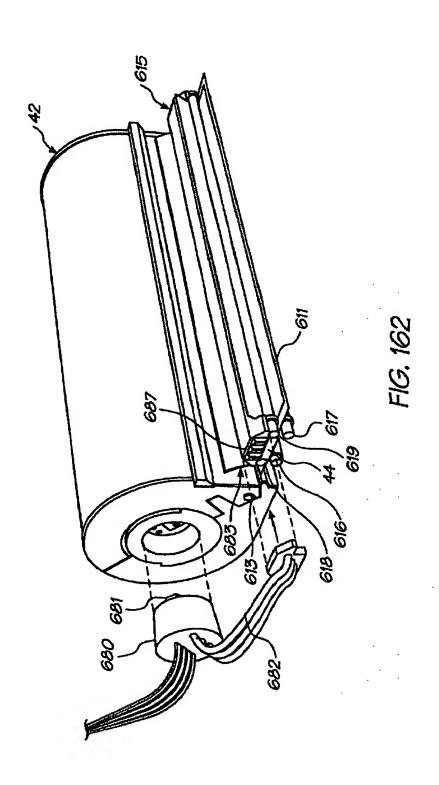




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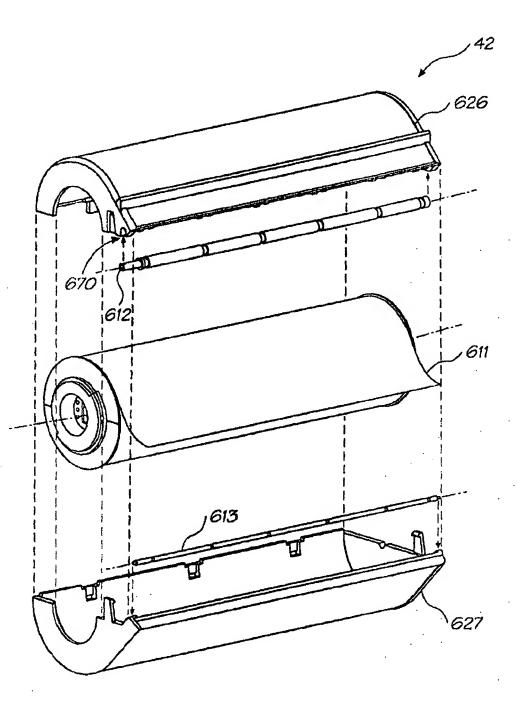
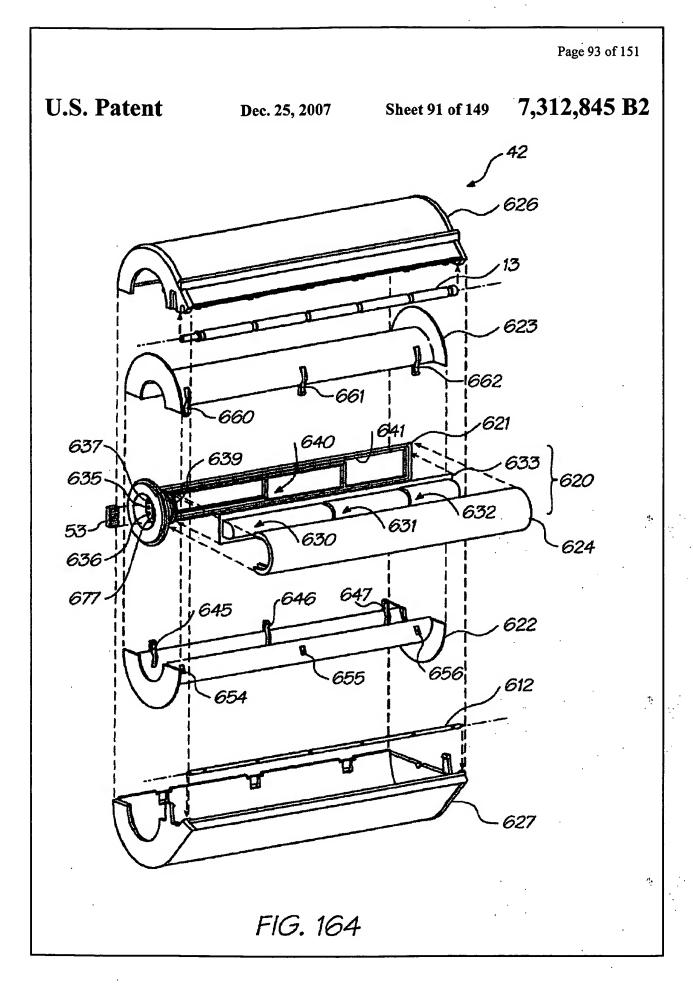


FIG. 163





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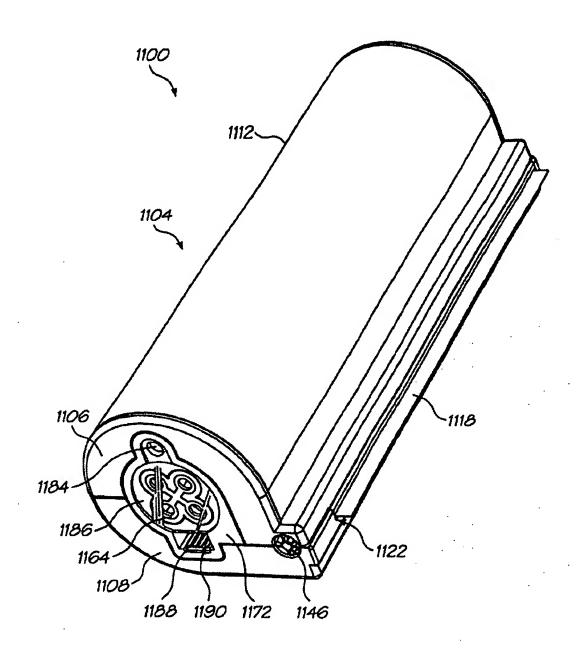
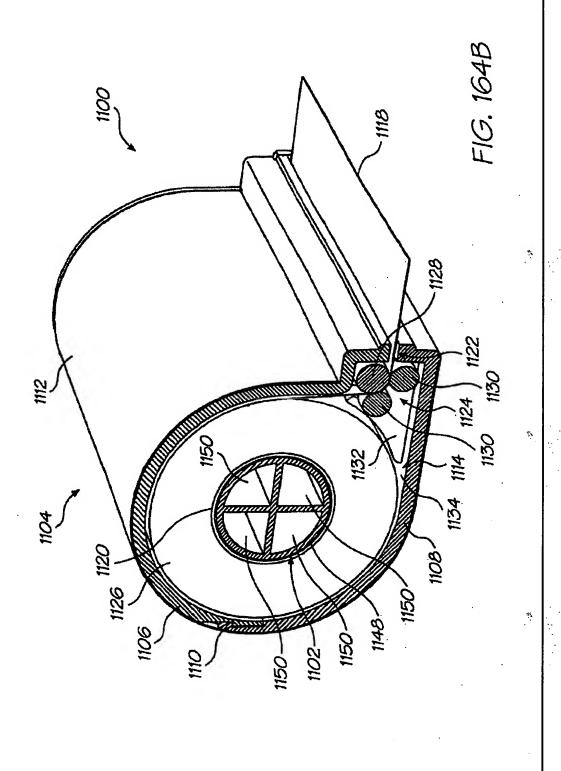


FIG. 164A

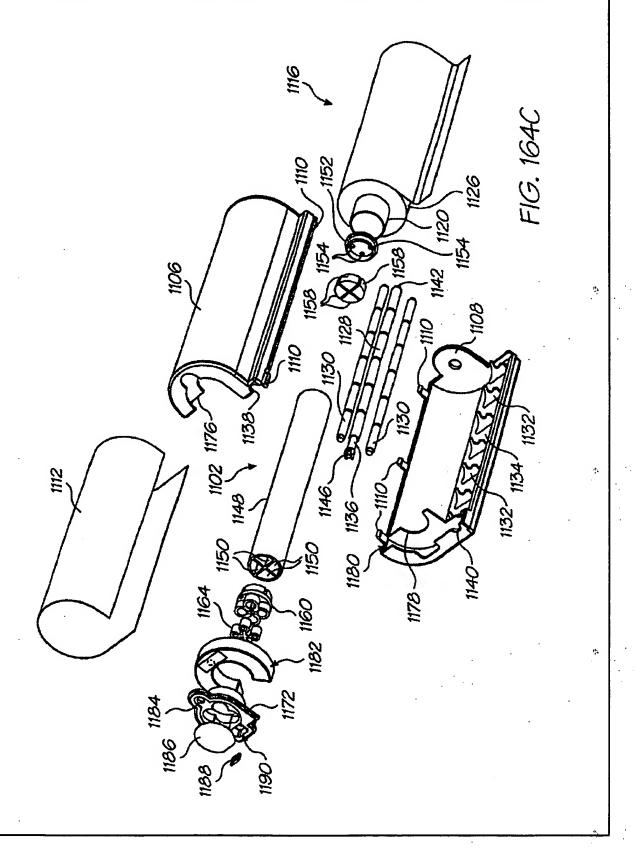
Dec. 25, 2007

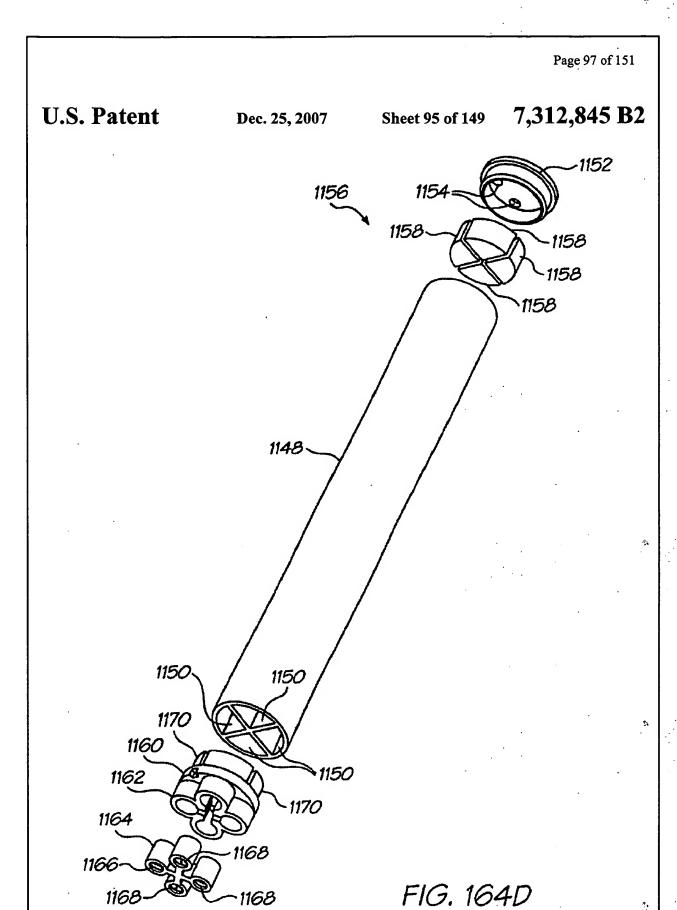
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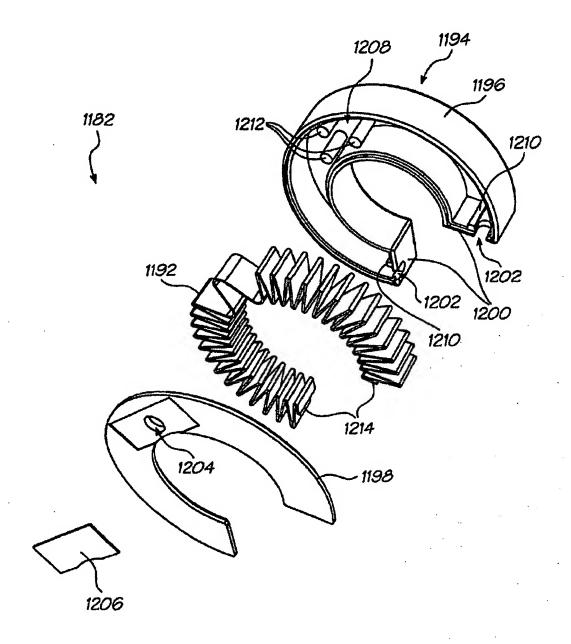


FIG. 164E

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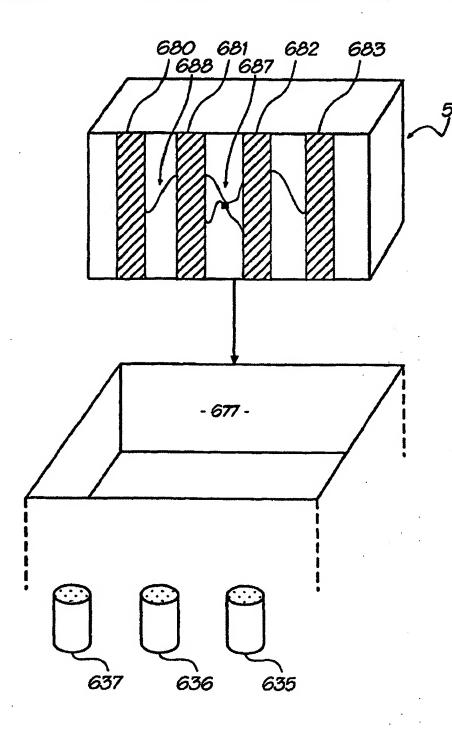


FIG. 165

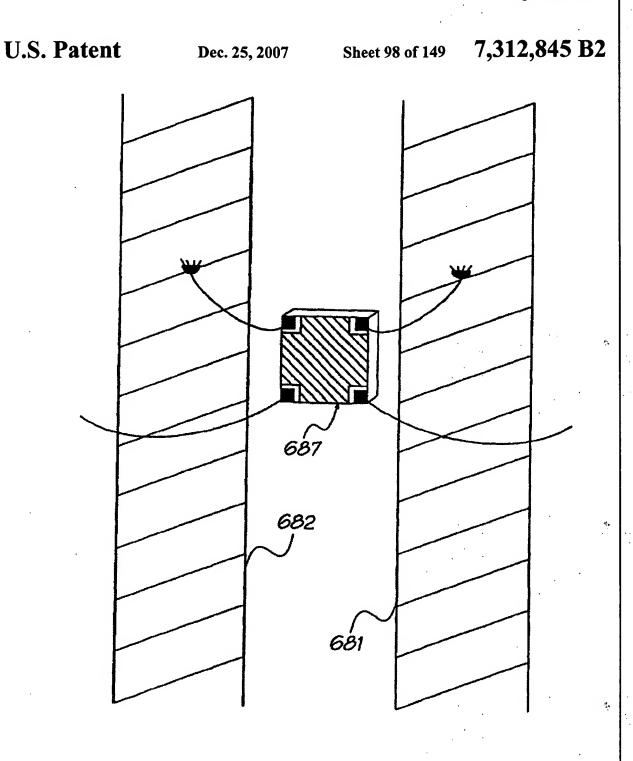


FIG. 166

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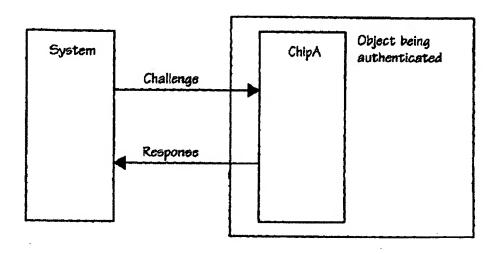


FIG. 167

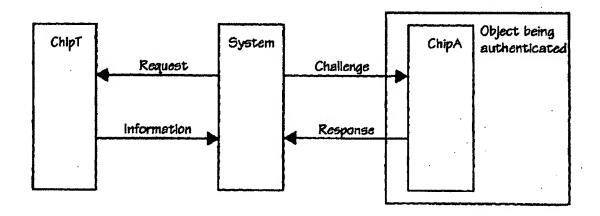


FIG. 168

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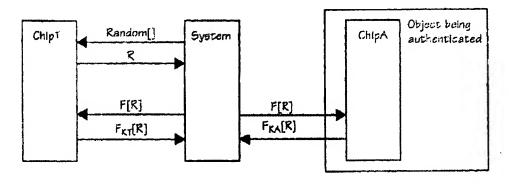


FIG. 169

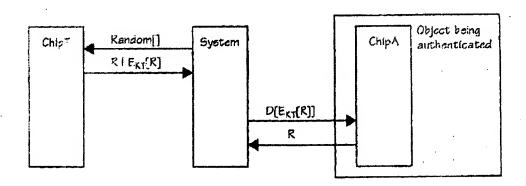


FIG. 170

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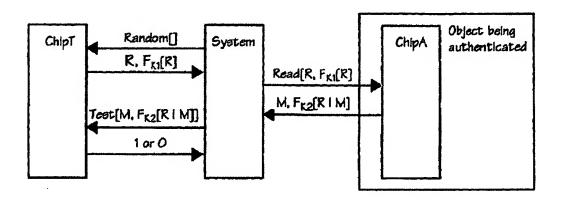


FIG. 171

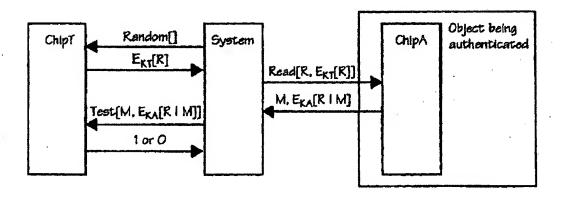


FIG. 172

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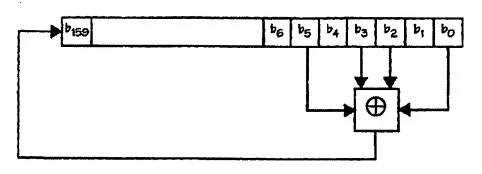


FIG. 173

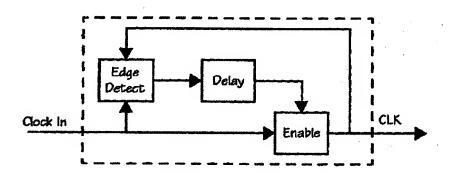


FIG. 174

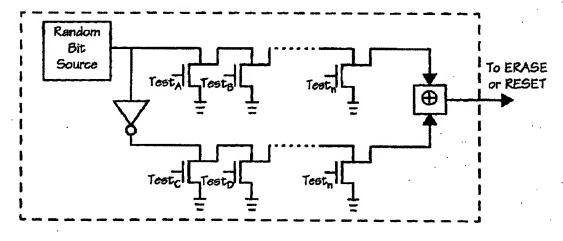


FIG. 175

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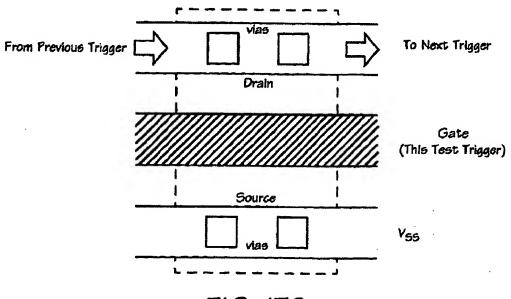


FIG. 176

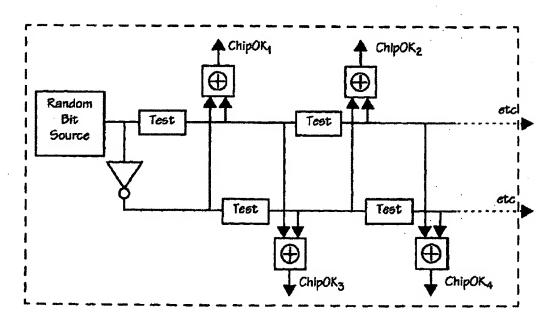
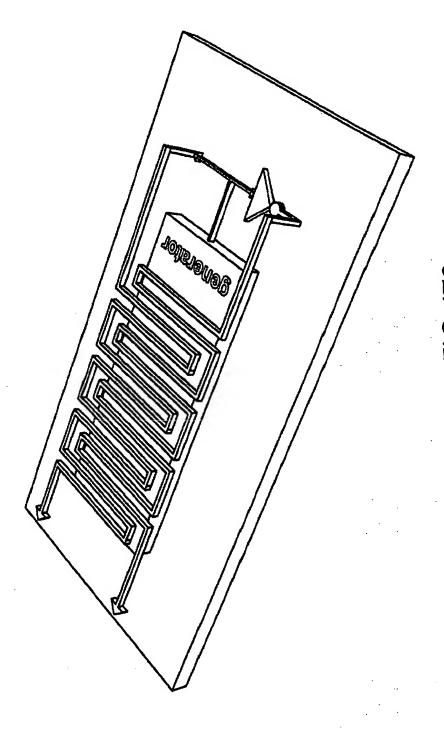


FIG. 177

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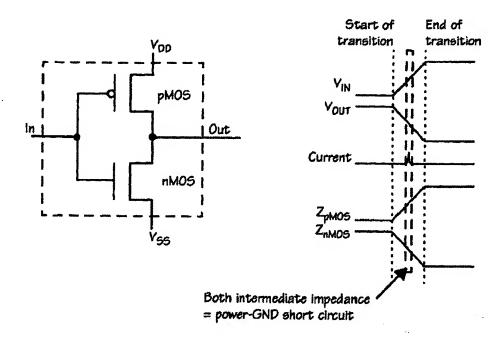


FIG. 179

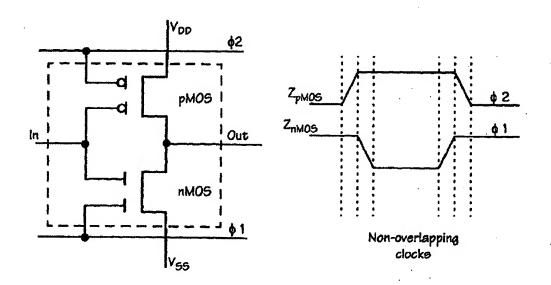


FIG. 180

*

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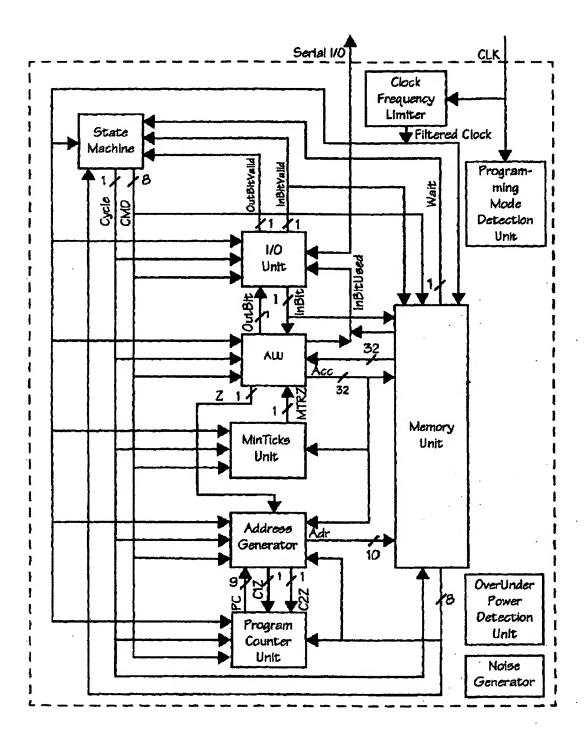


FIG. 181

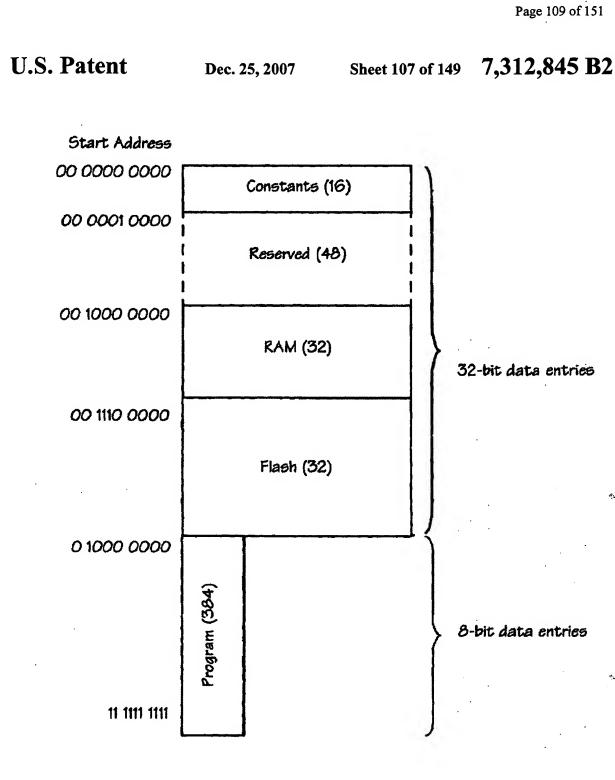
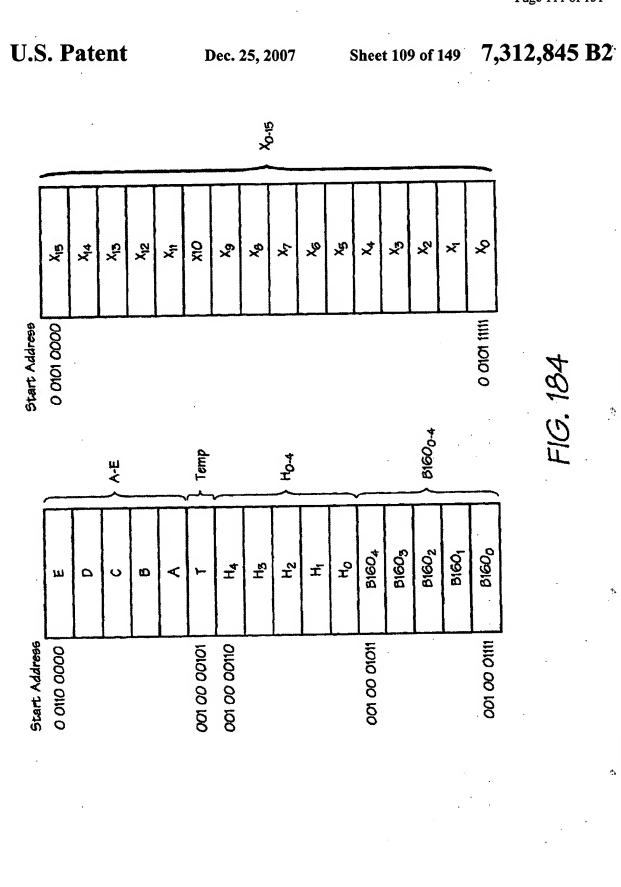


FIG. 182

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Start Address		•	
00 0000 0000	0x0000000		
	0x36363636	4 x 32-bit constants	
	0x5C5C5C5C	4 x 52-010 constants	
	Oxfffffff		
00 0000 000	Ox5A827999 (y ₀)		
	Ox6ED9EBA1 (yı)	4 x 32-bit y constants as	
	Ox8F1BBCDC (y ₂)	used by SHA-1.	
	OxCA62C1D6 (y3)		
00 0000 1000	0x67452301 (h ₀)	2.	
	OxEFCDAB89 (hi)		
	Ox98BADCFE (h2)	5 x 32-bit h constante as used by SHA-1.	
	Ox10325476 (h3)	·	
	OxC3D2EIFO (h4)		
Ī	Reserved (3)	Unused and unreferenced	
00 0000 1111			
	EIG 183		

FIG. 183



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Start Address	
0 1000 0000	A 1 Table 4 (30)
	Adr Table 1 (32)
0 1010 0000	4 1 7 11 0 (70)
	Adr Table 2 (32)
0 1100 0000	DBR Table (8)
0 1100 1000	·
!	Program (312)
11 1111 1111	·

FIG. 186

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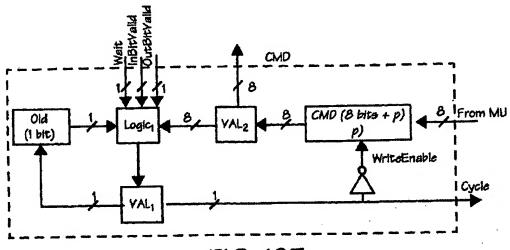


FIG. 187

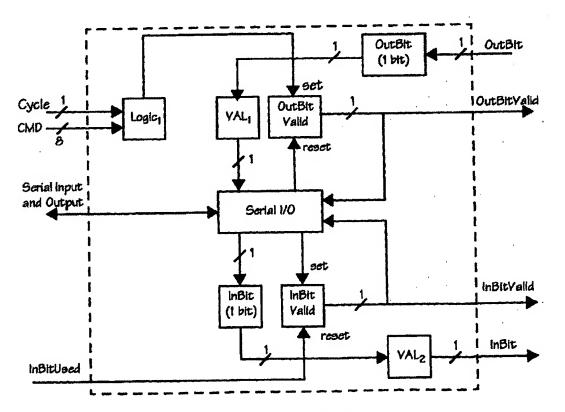
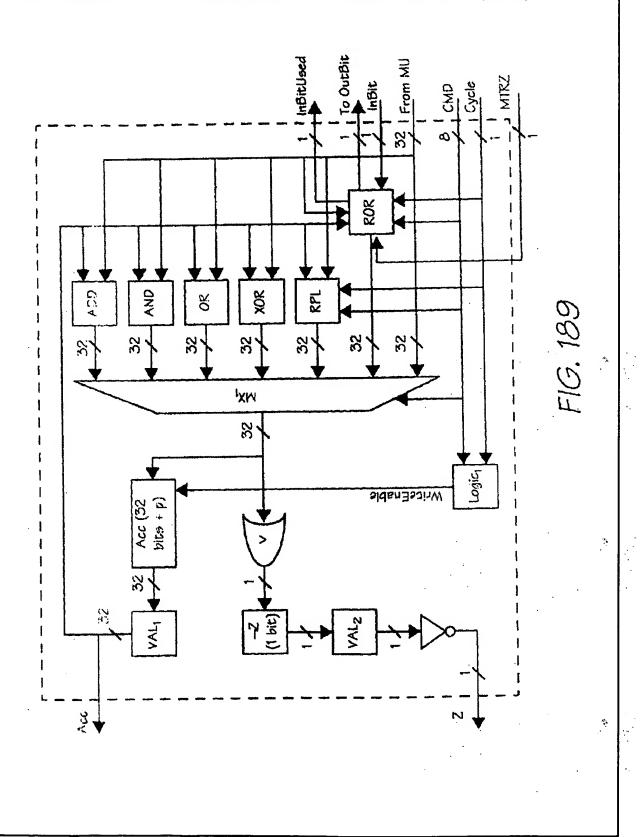


FIG. 188

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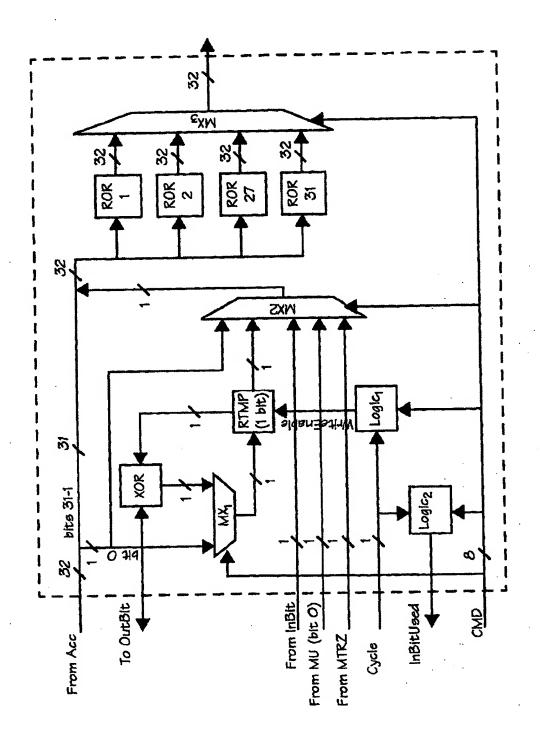


FIG. 190

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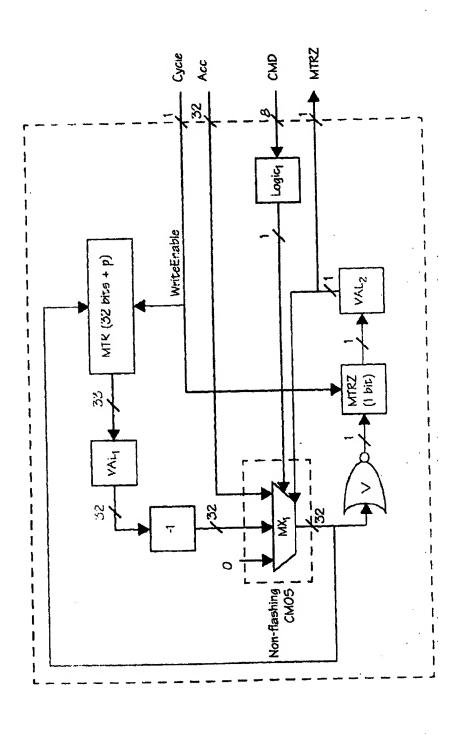


FIG. 191

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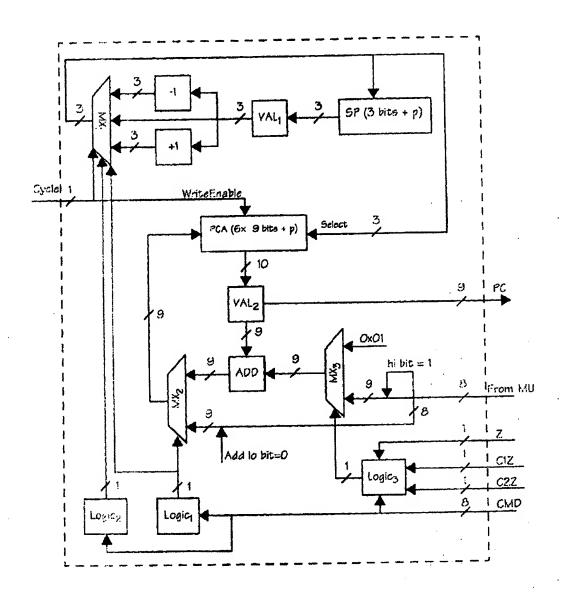


FIG. 192

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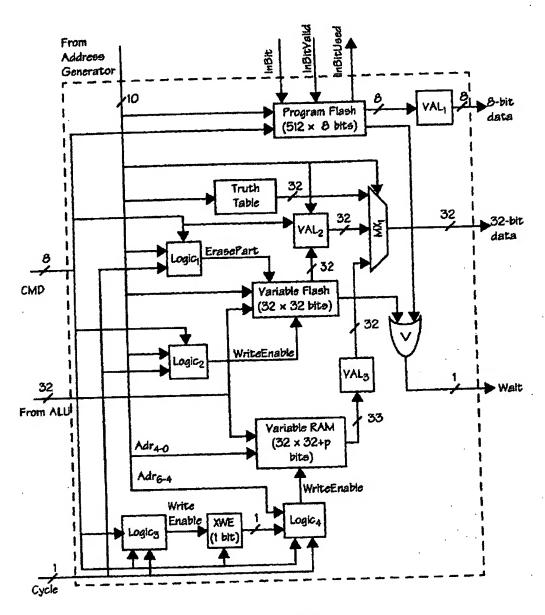


FIG. 193

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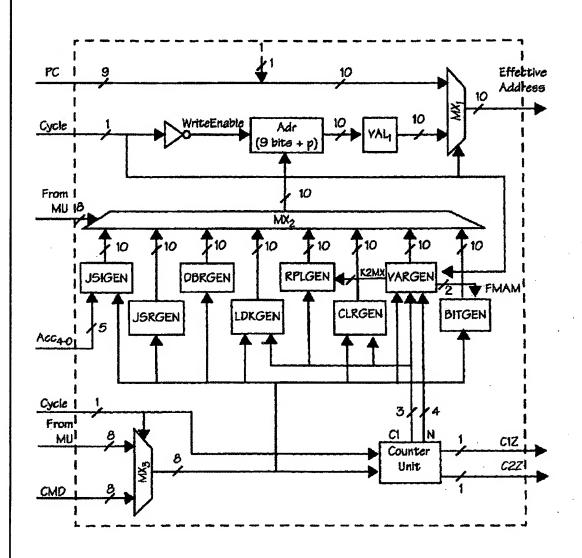


FIG. 194

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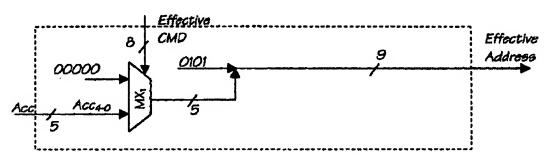


FIG. 195

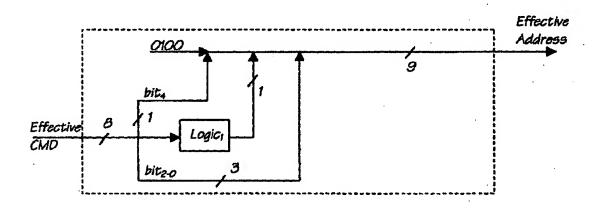


FIG. 196

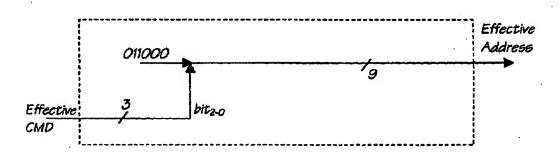


FIG. 197

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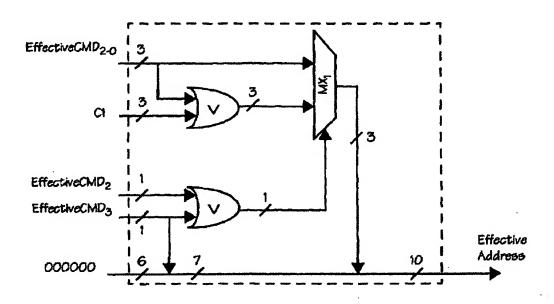


FIG. 198

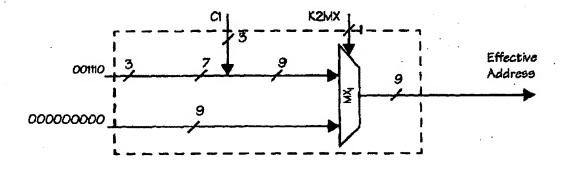


FIG. 199

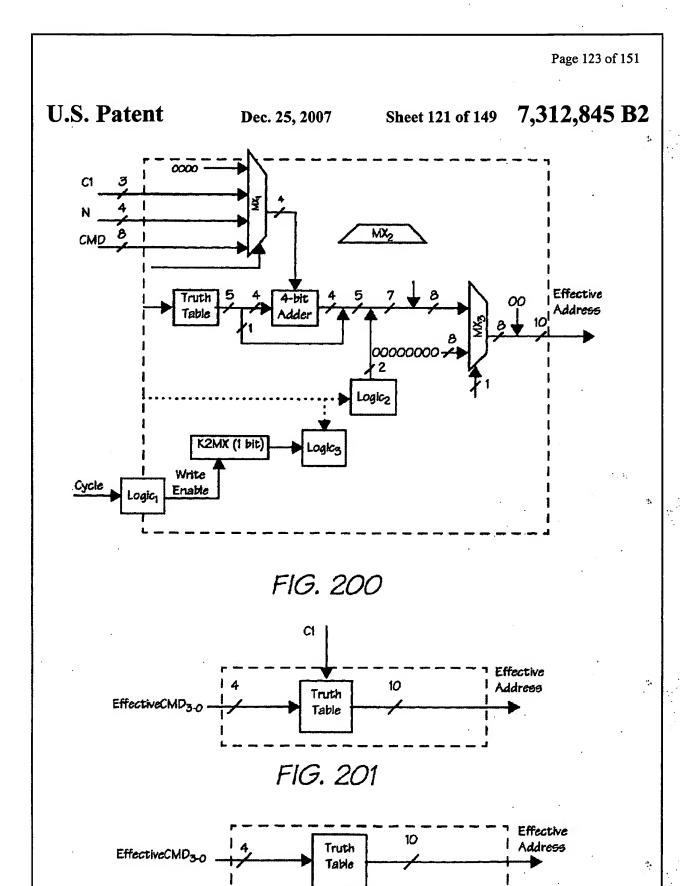


FIG. 202

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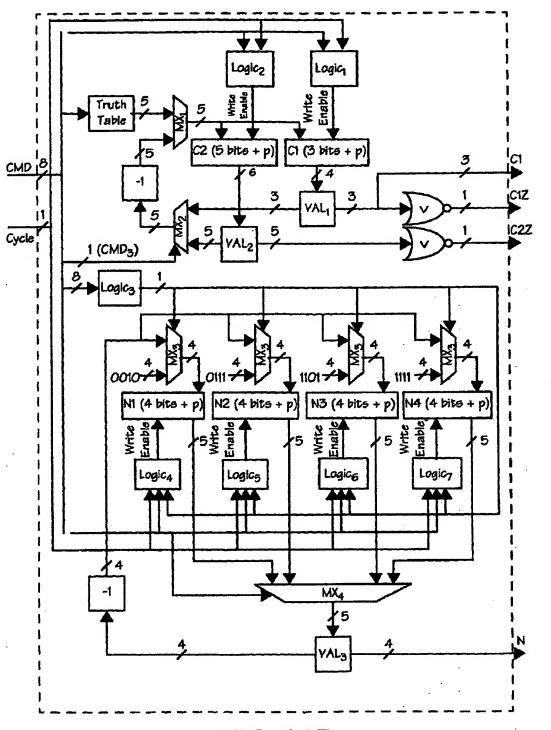


FIG. 203

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705

728 1

DATA TYPE	BITS
Factory Code	16
Batch Number	32
Serial Number	48
Manufacturing Date	16
Media Length	24
Media Type	· 8
Preprinted Media Length	16
Cyan Ink Viscosity	8
Magenta Ink Viscosity	8
Yellow Ink Viscosity	. 8
Cyan Drop Volume	8
Magerita Drop Volume	8
Yellow Drop Volume	8
Cyan Ink Color	24
Magenta Ink Color	24
Yellow Ink Color	24
Remaining-media Length Indicator	16
Authentication Key	128
Copyrightable bit pattern	512
Reserved for Camera Use	88
TOTAL	1024

FIG. 204

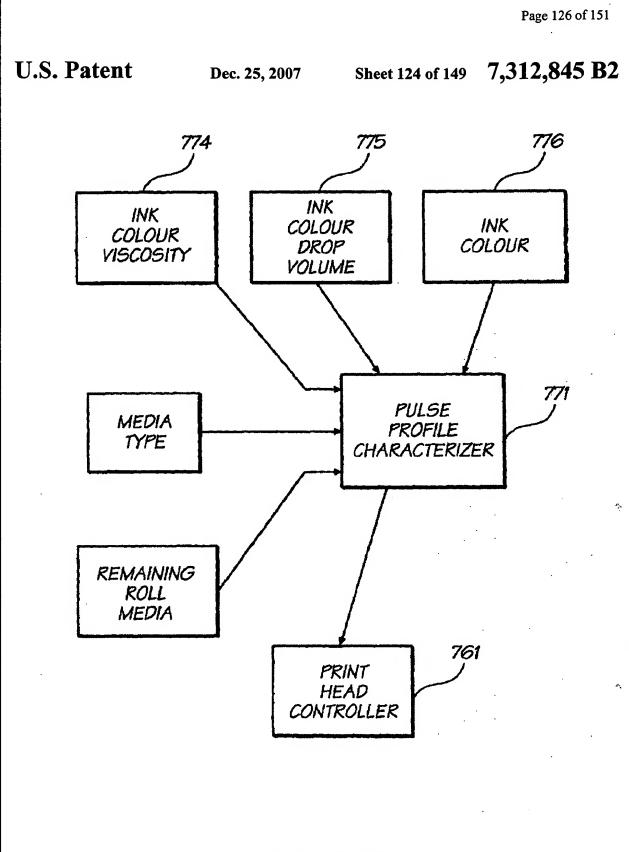
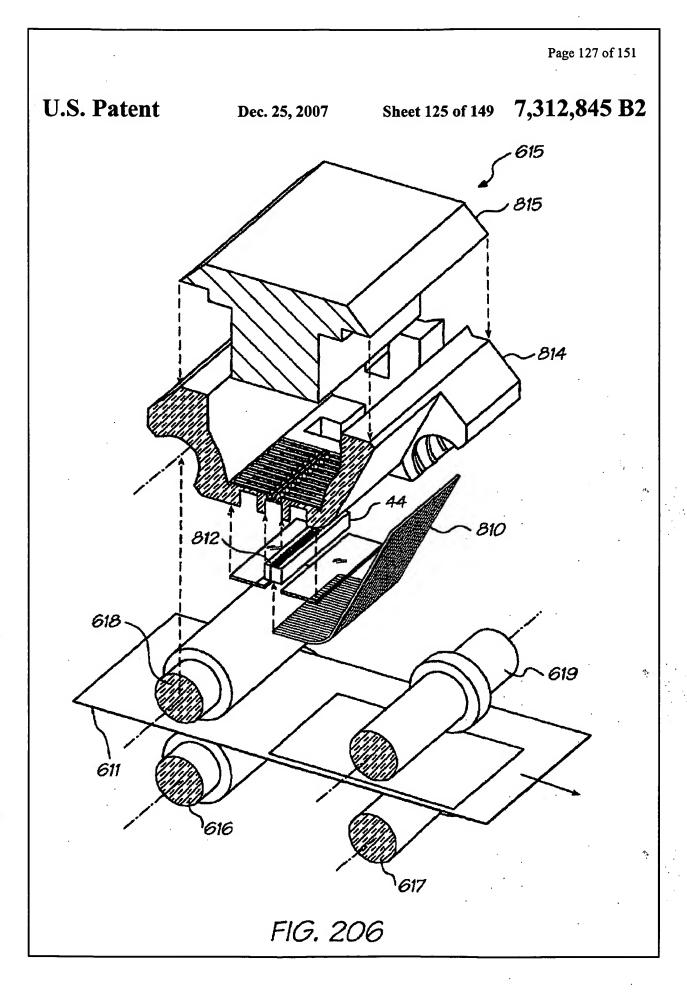
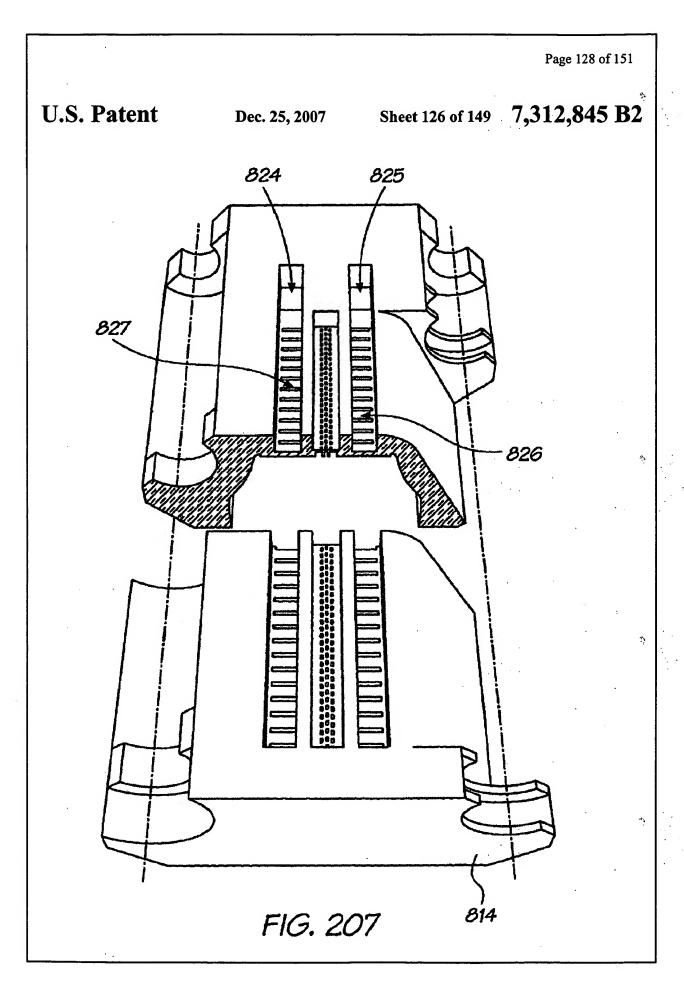
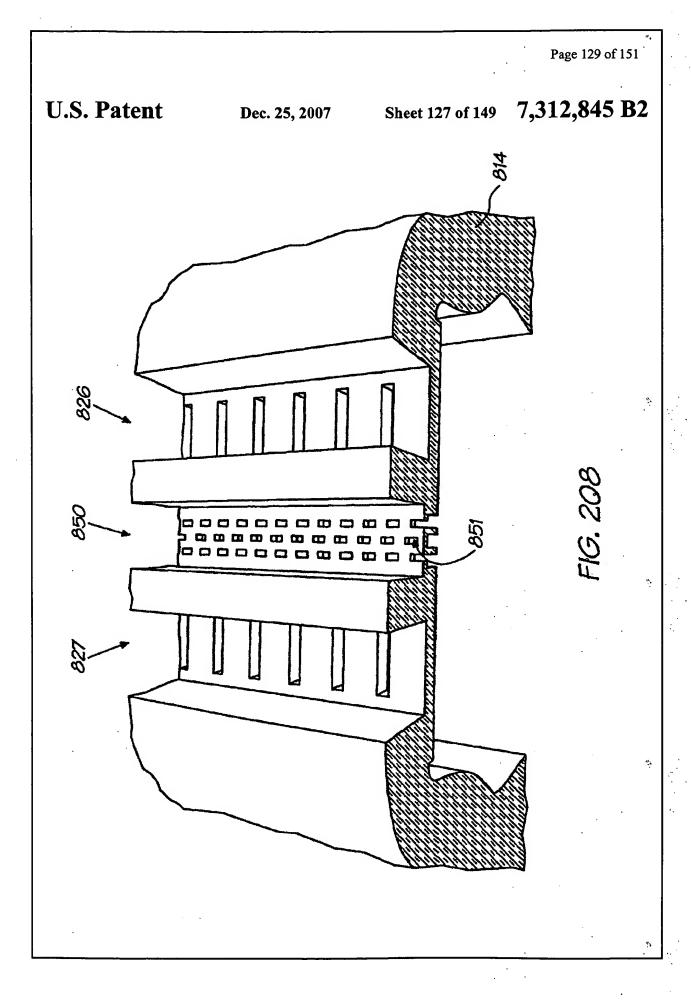


FIG. 205







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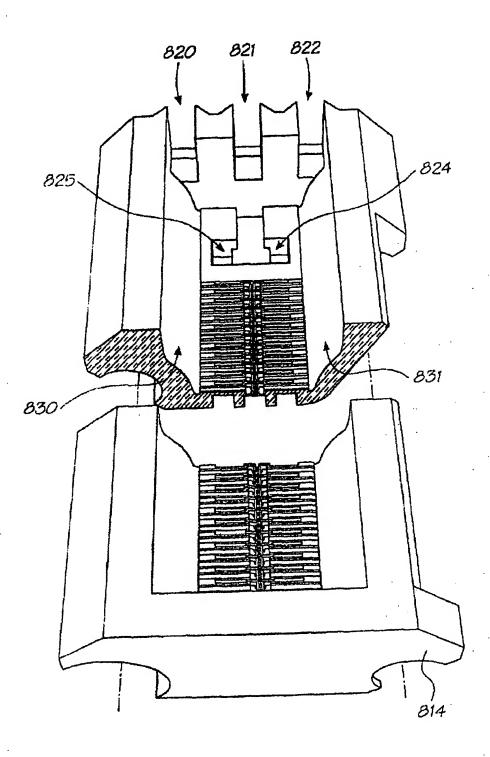
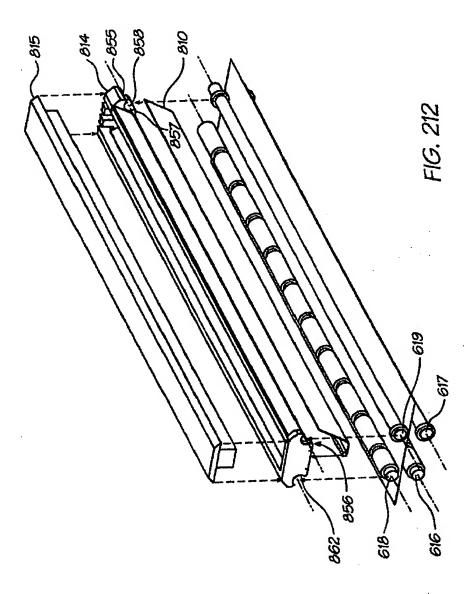


FIG. 209

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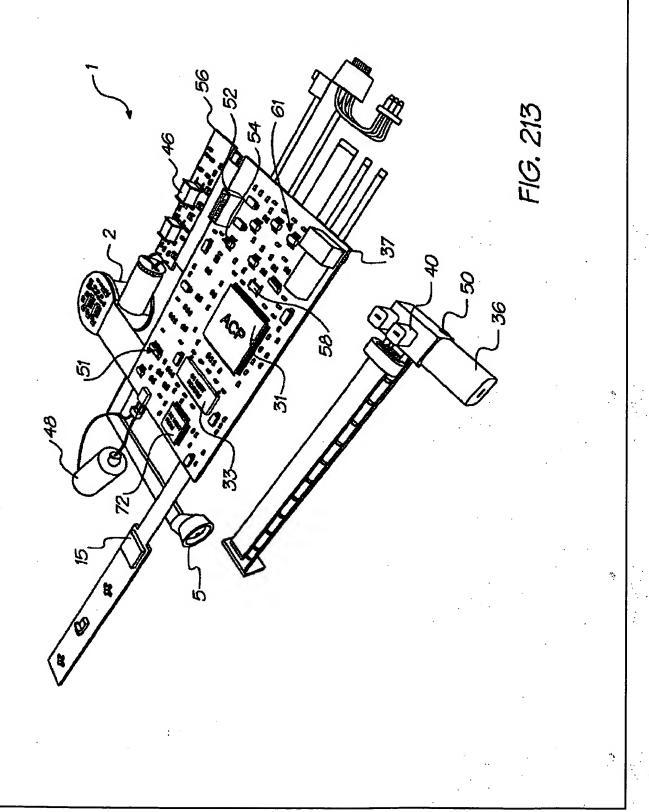
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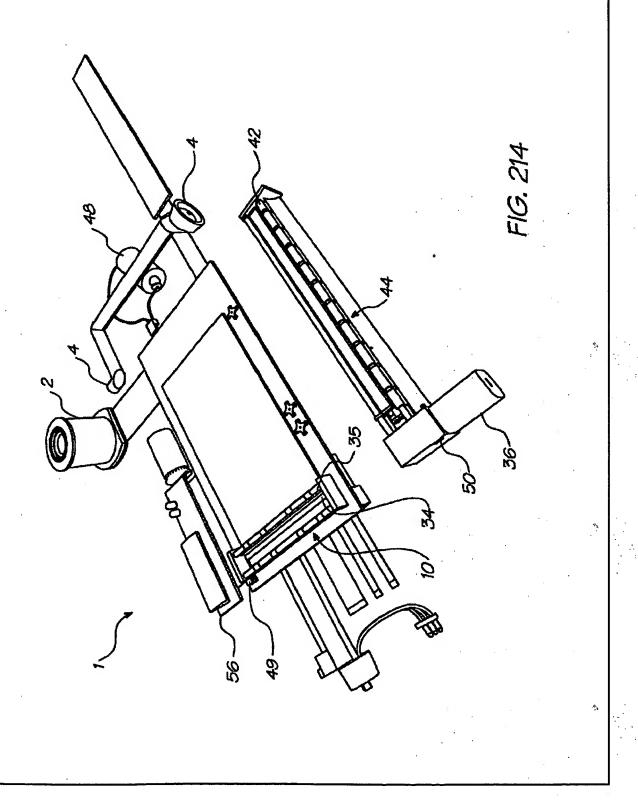


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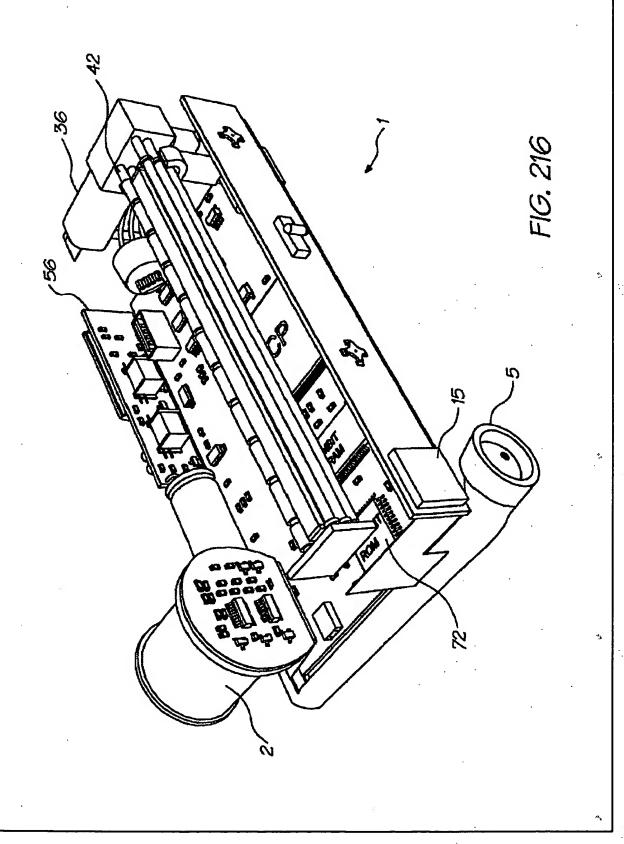


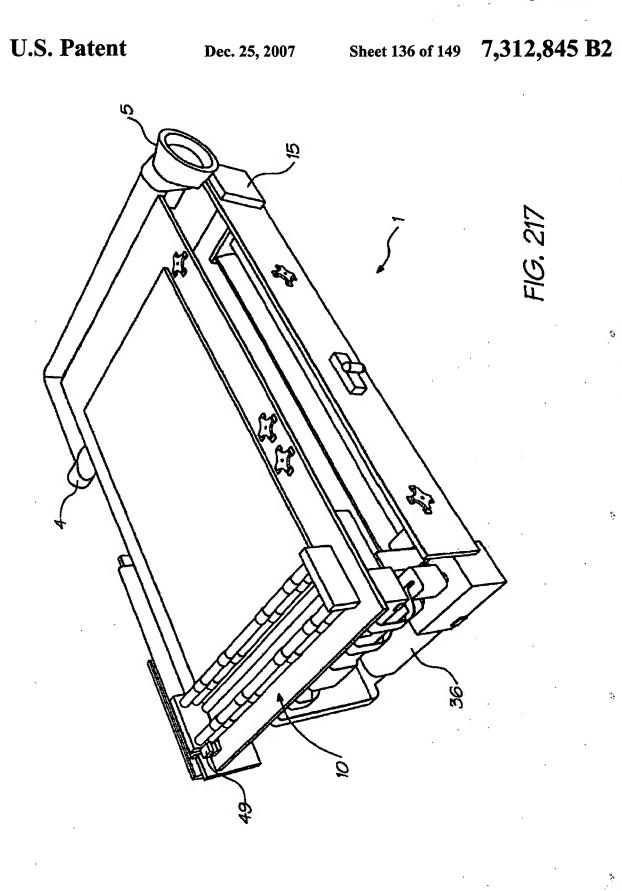
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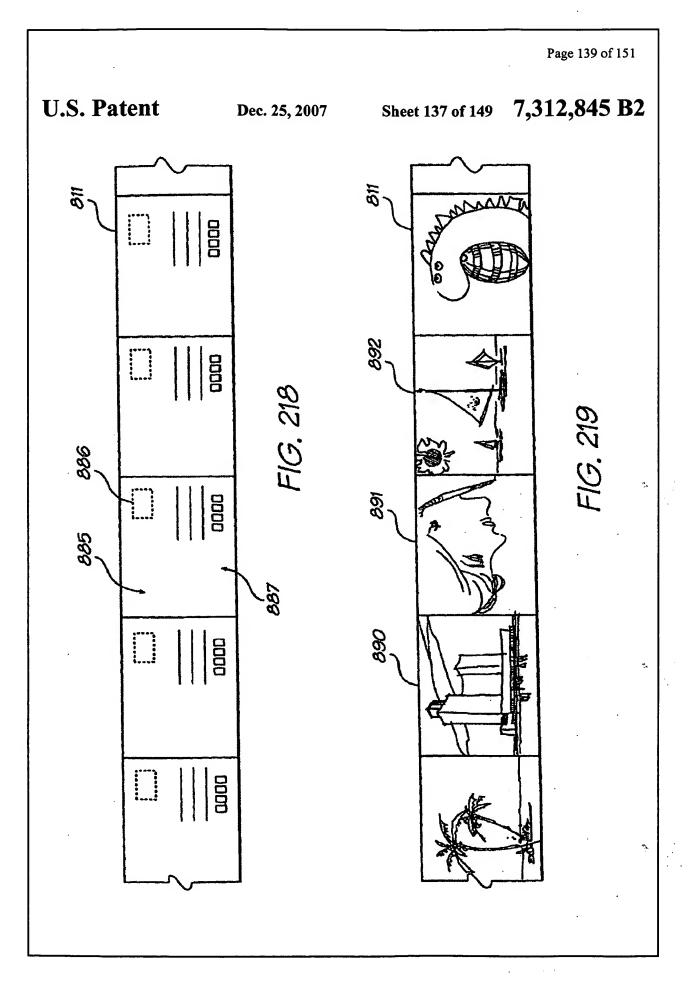


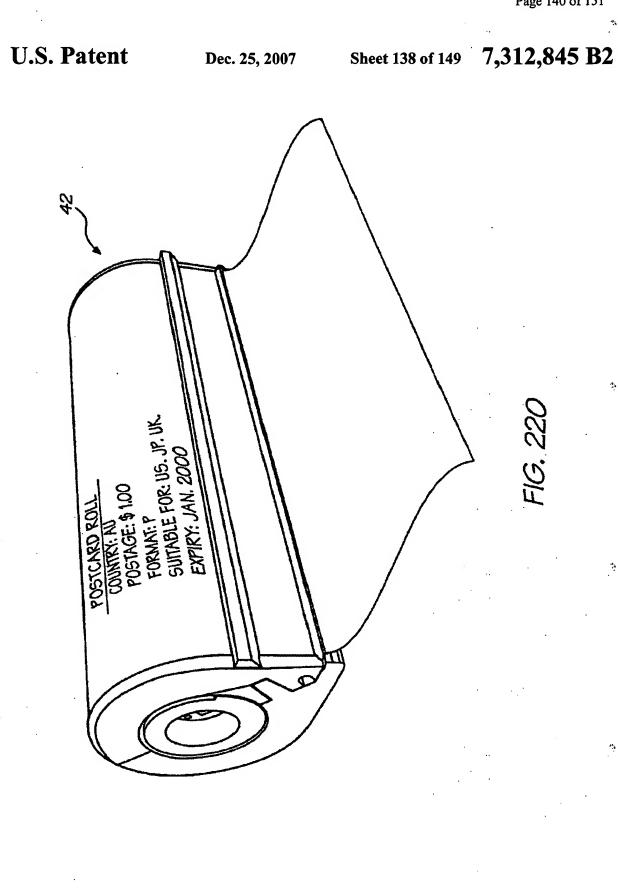
Page 136 of 151 U.S. Patent Dec. 25, 2007 Sheet 134 of 149 7,312,845 B2,

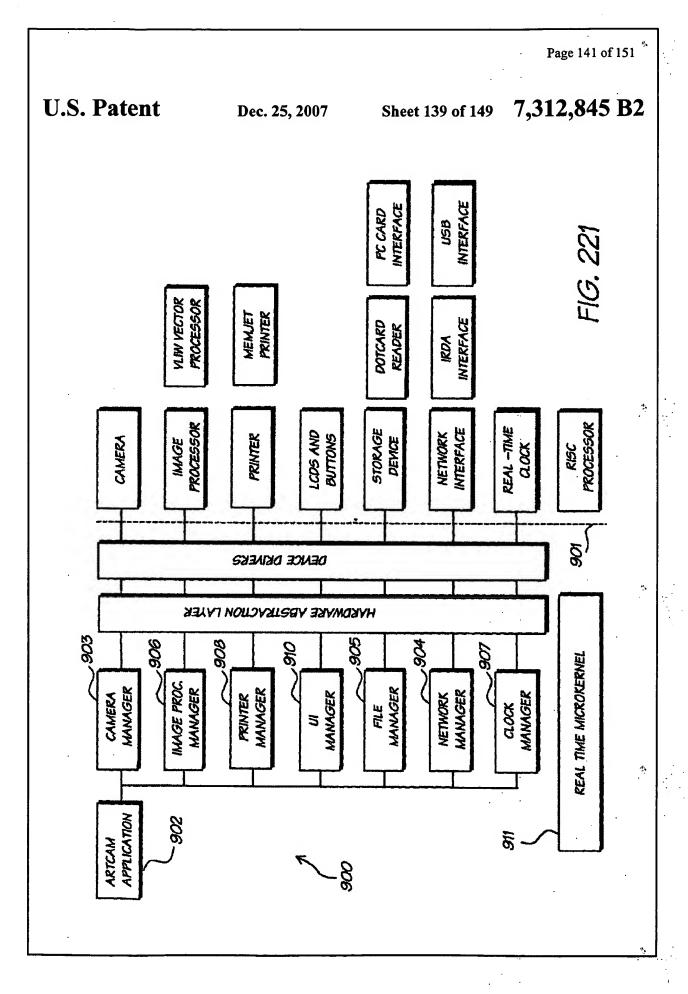
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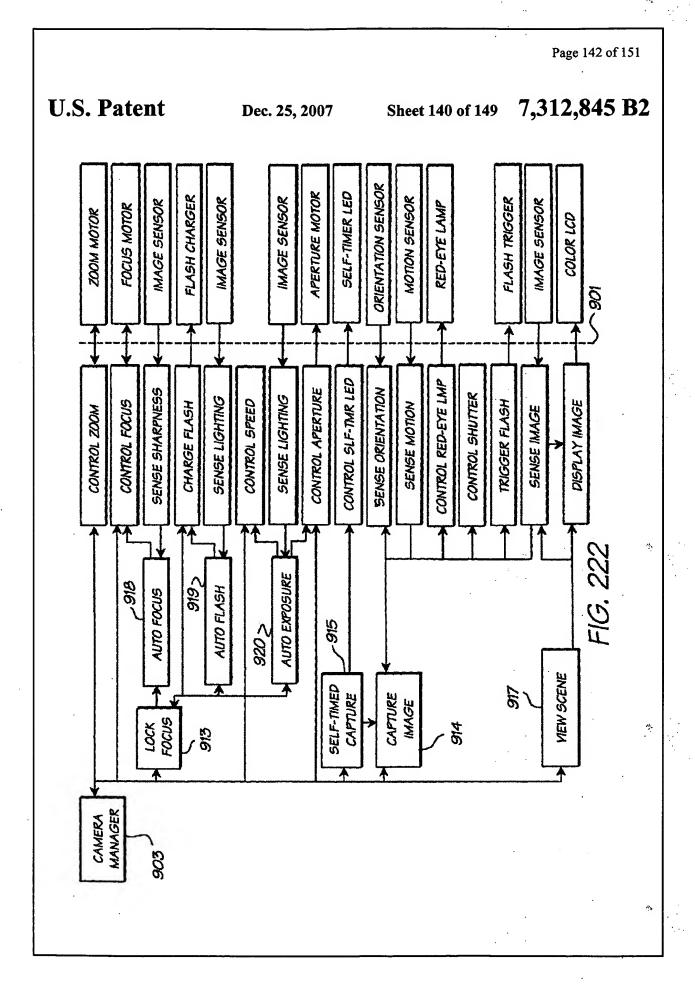


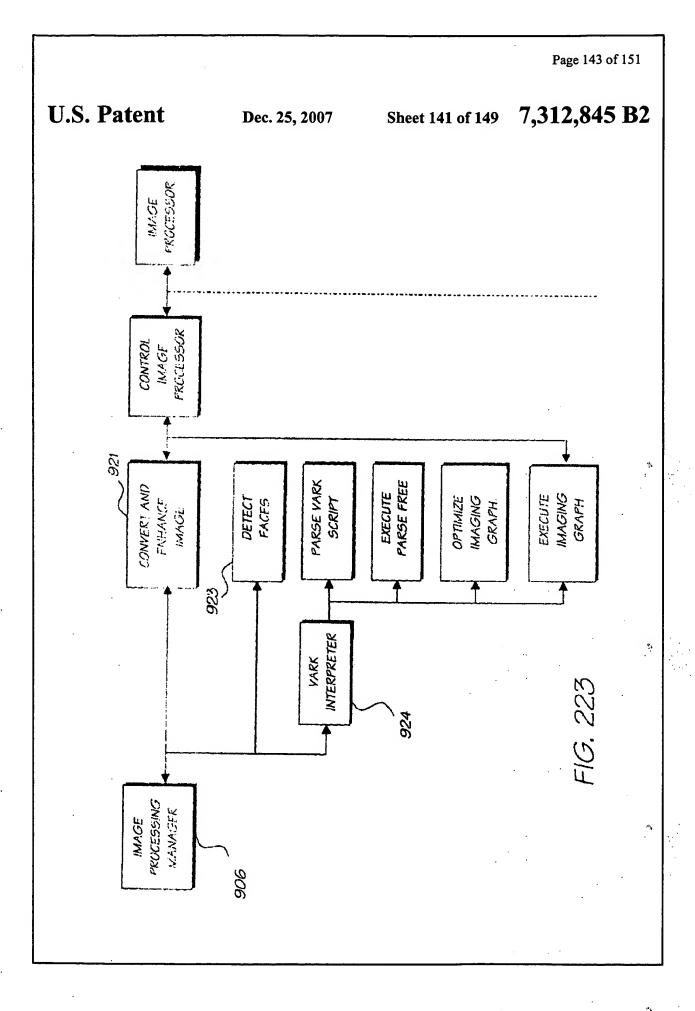


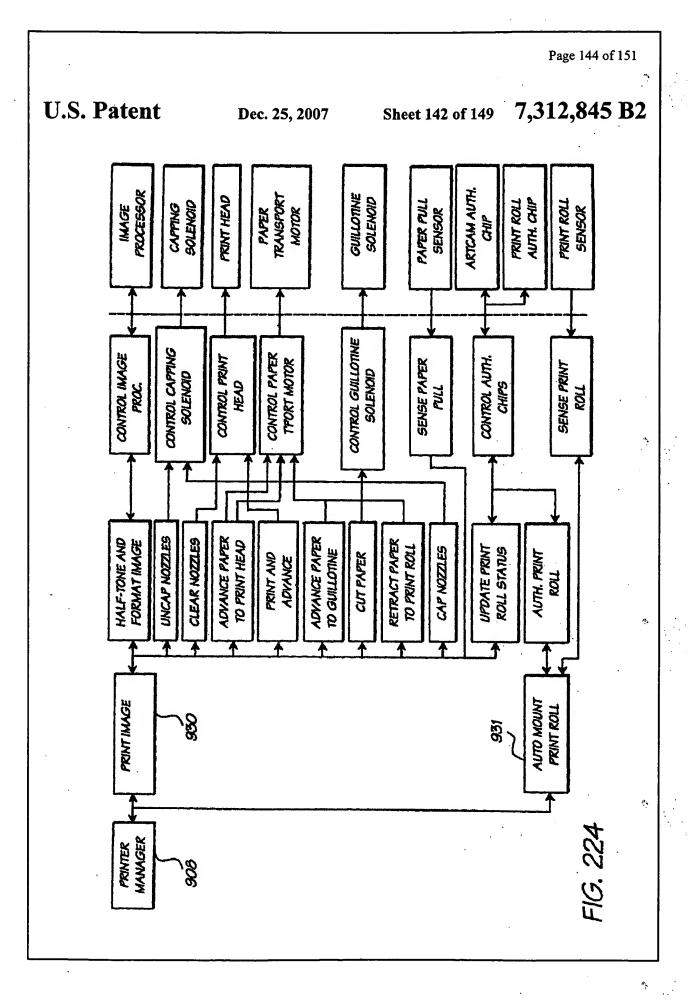


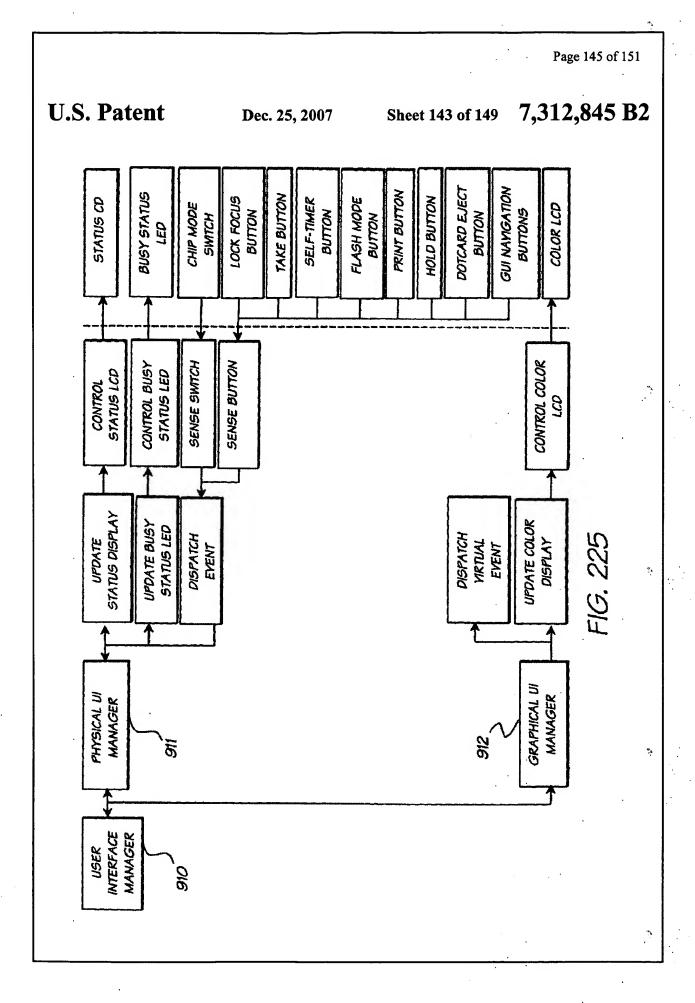


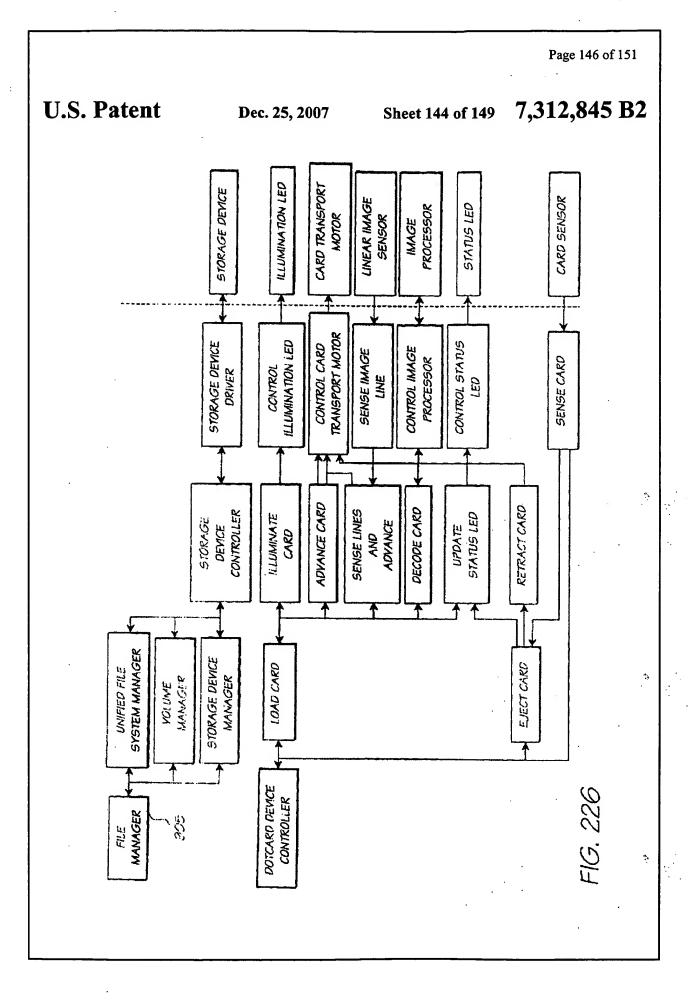


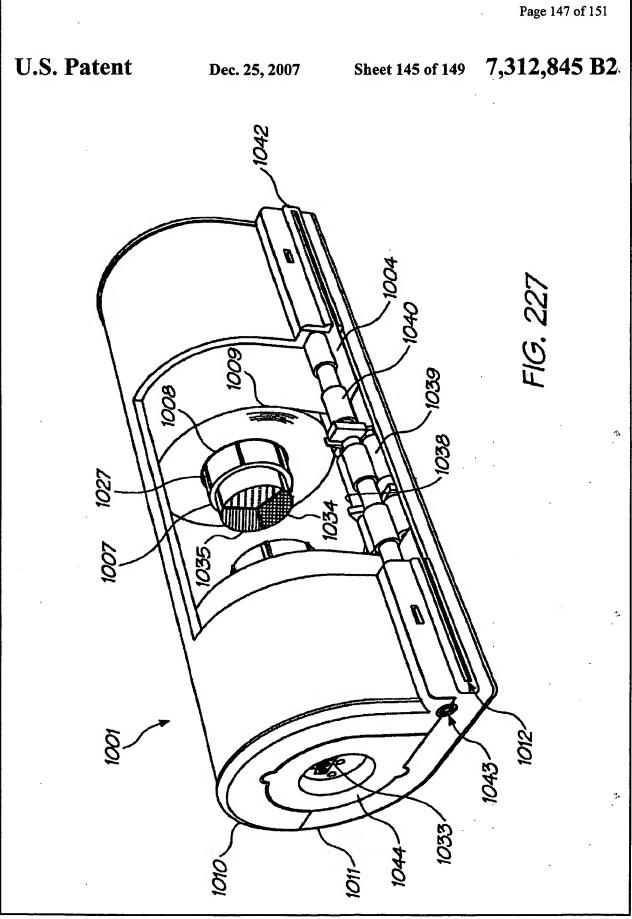








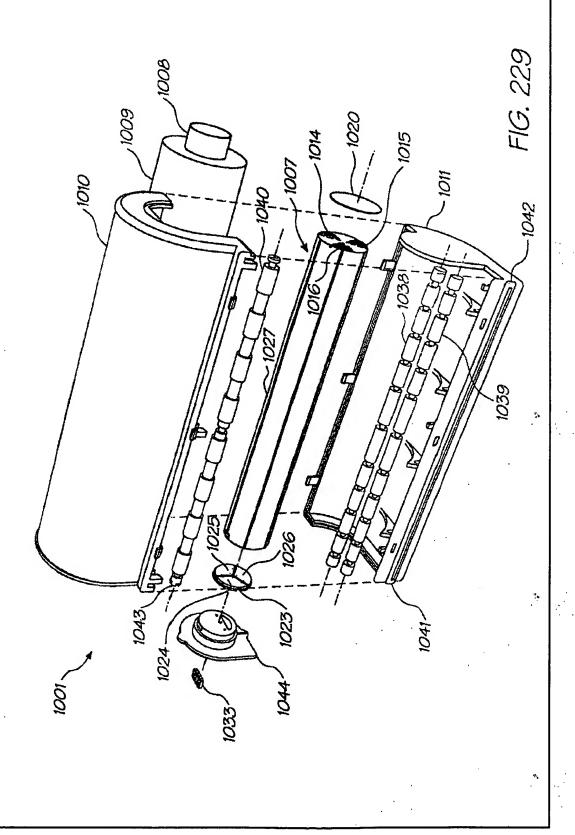




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